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MEDIASTINAL EMPHYSEMA*

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MEDIASTINAL emphysema was recognized and described more than a century ago and many case reports and articles dealing with this interesting condition are to be found in the literature. However, it is only within recent years that careful clinical observations and experimental investigation have established the causes and mechanisms of production. Pneumomediastinum as the result of trauma, disease of the lungs or surgical procedures of the neck occurs not uncommonly. Spontaneous emphysema, however, is a more uncommon occurrence and while, as Hamman[13] states, it is usually a benign condition, it is important that it be recognized so as not to confuse it with more serious disease. Scott,[31] as well as Hamman, pointed out that spontaneous mediastinal emphysema might closely simulate coronary disease, pulmonary embolism or acute pericarditis. Large amounts of air in the mediastinum may occasionally produce grave results and immediate recognition may be lifesaving. Mediastinal emphysema probably occurs much more frequently than is generally recognized. It is a complication that may present itself in a great variety of diseases. A review, therefore, of the causes, mechanisms of production, effects, clinical and roentgen findings, together with a report of 50 cases demonstrating some of the various circumstances under which it can occur, is presented.

It is generally felt that air may gain access to the mediastinum via four pathways: (1) by way of the interstitial tissues of the lungs, (2) along the fascial planes of the neck, (3) through perforations of the trachea, bronchus or esophagus and (4) by dissection along the retroperitoneal spaces. The very detailed and thorough experimental work of Macklin[17,18,19] has convincingly demonstrated that the first of these pathways is the usual one in the vast majority of cases. The mechanism of production, as demonstrated in Macklin's experiments, is the rupture of the pulmonary alveolar bases allowing the escape of air into the interstitial tissues of the lung. The air then tracks along the sheaths of the pulmonary vessels to the lung roots and enters the mediastinum. From the mediastinum air may dissect upward along the fascial planes of the neck, face and axillae and then may travel down over the chest and arms and may even extend down the lower extremities to reach the feet. The tension of air in the mediastinum may cause rupture of the mediastinal pleura with the

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production of a pneumothorax. Pneumothorax associated with mediastinal emphysema is a common occurrence and there are numerous such case reports in the literature.[2,23,24,26,28,29,32] Macklin states that rupture of the alveolar base occurs as the result of any of three conditions: (1) "Those in which there is first an atelectasis of some part of the lung followed by hyperinflation in adjoining regions of the same lung or in the opposite lung; (2) those in which there is a general hyperinflation with or without increased intra-alveolar pressure; (3) those in which there is evident a decreased blood supply to the pulmonary vessels, preferably either with increased intra-alveolar pressure or with hyperinflation." The existence of any of these three conditions produces a pressure gradient between the alveoli and the interstitial tissues and it is this pressure gradient which causes rupture of the alveolar bases.

That air may enter the mediastinum by way of the fascial planes of the neck has been known to surgeons for many years. Further evidence that this may occur under certain circumstances has recently been shown by Forbes, Salmon and Herwig,[11] who, in a study of 120 consecutive post-tracheotomy cases in the St. Louis Children's and City Hospital, found the incidence of mediastinal emphysema to be appreciable; it was diagnosed in 25 per cent of their cases. In a few of their cases they had the opportunity of careful preoperative examination including roentgenoscopy and chest films and were able to exclude preoperative presence of mediastinal emphysema. These same investigators, in experiments on tracheotomized dogs, were able to produce mediastinal emphysema and pneumothorax by obstructing the tracheal cannula to the point of dyspnea. By placing lipiodol and trypan-blue in the tracheotomy wound, the course of the air was traced to the mediastinum. In some of the dogs, rupture of the mediastinal pleura with resultant pneumothorax was observed.

Mediastinal emphysema may result from thoracic injuries or perforations of the esophagus, trachea or bronchi. Case 31 resulted from perforation of a pharyngeal diverticulum during esophagoscopy. Cases 28 and 29 developed mediastinal emphysema as the result of surgical trauma to the mediastinal pleura during splanchnicectomy for hypertension.

Pneumomediastinum resulting from extension of air along the retroperitoneal fascial spaces has been reported following perirenal insufflation, pneumoperitoneum, as a complication of air contrast injection following barium enema, occasionally following abdominal surgery and as a complication of dorsal sympathectomy.[4,22,27,34] In none of our cases were we able to demonstrate conclusively the origin of the mediastinal emphysema from the retroperitoneal fascial planes, although this seemed to be the pathway in Cases 22 and 23.

The effects of air in the mediastinum are the result of increased mediastinal pressure. The principal effect, as demonstrated in the experimental work of Ballon and Francis,[1] is mechanical pressure on the large veins of either side of the heart causing interference with flow of blood into the heart and, if the pressure rises high enough causing the veins to collapse and the circulation to come to a standstill. Jehn and Nissen,[14] in unusual experiments, showed that air injected directly into the mediastinum caused no symptoms if the pressure was maintained at ± 0. However, as more air was introduced and the mediastinal pressure increased, the blood pressure began to fall and cyanosis and intense dyspnea occurred. When the injection of air was stopped at this point some of the animals recovered, but in most animals the blood pressure continued to fall and death rapidly intervened. The autopsy findings on these animals revealed that the heart and large blood vessels were surrounded by air bubbles. The auricles and venae cavae and the large pulmonary veins were collapsed. Air was also found along the esophagus and aorta and had dissected down the aortic sheath through the diaphragm to the perirenal tissues.

Castellanos and Pereiras[6] injected air into the mediastinum as a diagnostic procedure in 40 children who had evidence of mediastinal pathology. They instilled from 40 to 150 cc. of air and reported no ill effects although they observed a drop in arterial pressure of 10–20 mm. Hg. during the instillation. Some of their patients complained of substernal pressure and pain. Montuschi[25] injected air into the mediastinum as a therapeutic measure in a case of pulmonary tuberculosis where the lesion was paramedian and anterior. Several refills of from 350 to 600 cc. of air were injected without untoward effects. The effects of the pneumomediastinum on the tuberculous infiltration are not stated.

Macklin[20] feels that interstitial emphysema produces the same mechanical pressure effect on the alveolar vessels that air in the mediastinum produces in the large vessels. He believes the cyanosis and dyspnea in any acute inflammatory disease of the lung is due in no small part to this factor.

Fifty cases of mediastinal emphysema have been collected from the records of the New York Hospital in the fourteen year period since 1935. An analysis of these cases forms the basis of this report. It is felt that an increasing awareness of the potential seriousness of this condition and an understanding of the factors which may produce it will result in more frequent recognition even in the presence of small amounts of air. The diversity of conditions in which this complication may arise is synoptically arranged in Table 1. Space does not permit a detailed presentation of all our cases and therefore only a few have been selected which best illustrate characteristic or interesting roentgen findings and demonstrate the various mechanisms and pathways by which air gains access to the mediastinum.

The mode of production in Case 18 was pulmonary interstitial emphysema following a prolonged and difficult combined abdominal-perineal resection. The anesthetic was cyclopropane in a closed circuit. The morning following operation there was slight subcutaneous emphysema which became severe one day later. A portable chest film (Fig. 1) on the first postoperative day showed massive mediastinal emphysema and bilateral pneumothorax. Attempt was made operatively to relieve the mediastinal tension but without success and the patient died in acute respiratory distress on the third postoperative day. Postmortem revealed massive emphysema of the mediastinal tissues. The left pleural cavity was obliterated by old, fine, fibrous adhesions which were dissected and expanded by massive interstitial emphysema. The visceral pleura showed many 0.5–1 cm. blebs. Both lungs showed marked emphysema and there were small fibrocalcific infiltrations at both apices. Microscopic

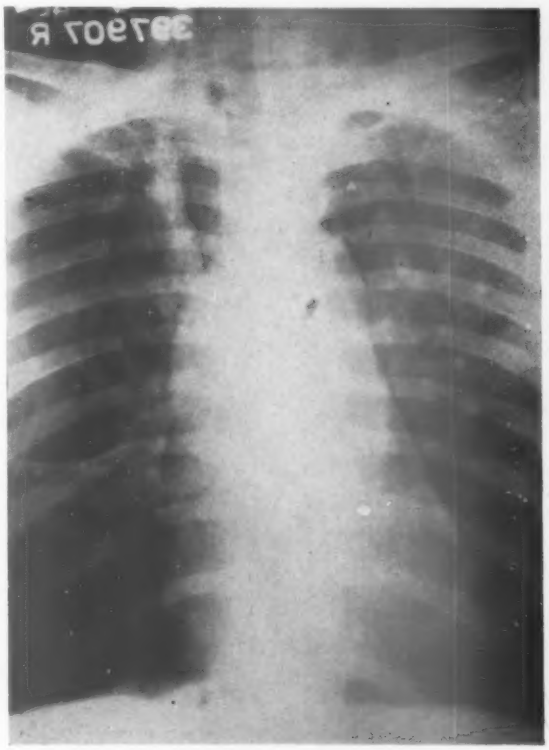

FIG. 1. Male, aged fifty, portable examination first day after abdominal-perineal resection. Note massive mediastinal emphysema as shown by radiolucent streaks and mediastinal pleural reflections. The right pneumothorax (arrow) and atelectasis are also visualized.

TABLE I

Case Number	Hospital Number	Age	Sex	How Diagnosed	Initiating Factors	Past History	Subcutaneous Emphysema	Pneumothorax	End Results	Mechanism
					Tracheotomy Group					
1	275252	3 yr.	M	Clinically and postmortem	"Croup" known 18 hr. before tracheotomy	None	No	Yes	Died 10 hr. post-tracheotomy	P.I.E.*
2	248892	20 days	M	Postmortem	Congenital vascular anomaly (aortic ring) tracheotomy	Severe dyspnea, cyanosis since birth	No	No	Died 20 hr. post-tracheotomy	P.I.E.
3	438312	4 yr.	F	Roentgenogram	Severe dyspnea following palatoplasty; tracheotomy	Bronchopneumonia twice; cleft palate	Yes	Bilateral	Recovery	P.I.E.
4	490222	20 mo.	M	Roentgenogram	"Croup" tracheotomy on admission	Non-contributory	No	Bilateral	Recovery	P.I.E.
5	509908	69	M	Roentgenogram	Carcinoma larynx (obstruction) on admission	Non-contributory	Yes	No	Mediastinal emphysema subsided; discharged without further treatment	Direct trauma
6	372996	14 mo.	M	Roentgenogram	Acute pharyngitis and laryngotracheitis; tracheotomy on admission; pretracheotomy chest x-ray negative	Non-contributory	Yes	Tension pneumothorax right; aspirated	Mediastinal emphysema and pneumothorax disappeared in 9 days; recovery	Post-tracheotomy
7	338630	7 wk.	F	Roentgenogram	"Croup" severe respiratory distress; tracheotomy day after admission; 1 day post-tracheotomy chest film showed atelectasis	Normal delivery; neonatal period unremarkable; thrush on discharge	Yes	No	Recovery	Questionable post-tracheotomy
8	533554	16 mo.	M	Roentgenogram	Sudden choking spell; respiratory distress; laryngeal stridor; submitted x-ray chest 24 hr. prior to hospitalization showed partial atelectasis left lung; x-ray on admission negative except for pulmonary emphysema; admission tracheotomy; post-tracheotomy chest film revealed mediastinal emphysema	Non-contributory	No	No	Recovery	Questionable post-tracheotomy
9	323146	13 mo.	F	Roentgenogram	Lymphangioma neck, acute tonsillitis, severe respiratory distress for 3 days prior to admission; tracheotomy	Lymphangioma neck since birth	No	No	Recovery	Questionable post-tracheotomy
10	258856	73	M	Roentgenogram	Tracheotomy for sudden edema of epiglottis; poor fit of tracheotomy tube necessitating change	Lympho-epithelioma involving epiglottis; 2 yr. prior to admission; roentgen therapy; followed 2 yr. without evidence of disease	Yes	No	Recovery	Post-tracheotomy
					Operative Group					
11	49755	24	F	Roentgenogram	Attempt at pneumothorax complicated by adherent pleura	Pulmonary tuberculosis previously; no artificial pneumothorax; 3 pneumolyses	No	Artificial	Recovery	Direct trauma
12	134177	31	M	Roentgenogram	Pneumothorax refill	Pulmonary tuberculosis with artificial pneumothorax; emphysema	Yes	Artificial	Died respiratory failure 7 days (tbc.)	Direct trauma
13	300459	23	F	Roentgenogram	Attempt at pneumothorax complicated by adherent pleura	Pulmonary tuberculosis	Yes	Artificial	Subsided; died 3 yr. later, (tbc.)	Direct trauma
14	358513	4 mo.	F	Roentgenogram, postmortem	Tracheal obstruction, dyspnea, thymectomy for thymoma	Bronchiolitis, obstructing mass in mediastinum	No	Yes	Died 6 days empyema, pericarditis	Direct trauma
15	420719	26	F	Roentgenogram	Thoracotomy, removal pneumatocele	Pneumatocele, right	Yes	Yes	Recovered, mediastinal emphysema aspirated	P.I.E.
16	79086	29	M	Postmortem	Lobectomy for bronchiectasis (long operation)	Bronchiectasis	Yes	No	Died 2 hr. postoperative	Direct trauma
17	258045	63	M	Roentgenogram	Thoracotomy, bronchogenic carcinoma (inoperable)	"Arrested" tbc. 5 yr.; emphysema	Yes	Yes	Died after transfer to another hospital	P.I.E.
18	397507	50	M	Roentgenogram, postmortem	Abdominal-perineal resection; carcinoma rectum; lengthy operation, closed circuit cyclo-propane	Pulmonary tuberculosis fibrocalcific, minimal, pulmonary emphysema	Yes	Bilateral	Died 3 days malignant mediastinal emphysema	P.I.E.
19	502701	64	M	Roentgenogram	Laparotomy for carcinoma rectum; not resectable; difficult anesthesia, intratracheal	Pulmonary emphysema	Yes	No	Died 9th postoperative day	P.I.E.
20	230506	75	M	Roentgenogram	Dismantling of old gastroenterostomy	Pulmonary emphysema	Yes	Yes	Recovered; repeated mediastinal aspirations	P.I.E.
21	512819	64	M	Roentgenogram	Transthoracic subtotal gastric resection for carcinoma cardia stomach; anesthesia endotrachial, closed ether	Non-contributory	Yes	Yes	Recovery	Surgical trauma
22	498402	59	M	Roentgenogram	Subdiaphragmatic vagotomy for duodenal ulcer	Duodenal ulcer	No	No	Recovery	Probable extension along abdominal aorta through diaphragmatic hiatus
23	225983	77	M	Roentgenogram	Abdominal thoracic gastrectomy for carcinoma stomach	Non-contributory	Yes	No	Recovery	Probable extension along abdominal aorta through diaphragmatic hiatus
24	549763	4 days	M	Roentgenogram	Esophageal anastomosis secondary to esophageal tracheal fistula	Non-contributory	No	Right	Died 2nd postoperative day bronchopneumonia	Surgical trauma
25	187857	53	M	Roentgenogram	Exploratory laparotomy for gastric ul-	Non-contributory	Yes	Right	Recovery	P.I.E.

22	498402	50	M	Roentgenogram	Subdiaphragmatic vagotomy for duodenal ulcer	Duodenal ulcer	No	No	Recovery	Probable extension along abdominal aorta through
23	125983	77	M	Roentgenogram	Abdominal thoracic gastrectomy for carcinoma stomach	Non-contributory	Yes	No	Recovery	Probable extension along abdominal aorta through diaphragmatic hiatus
24	549763	4 days	M	Roentgenogram	Esophageal anastomosis secondary to esophageal tracheal fistula	Non-contributory	No	Right	Died 2nd postoperative day bronchopneumonia	Surgical trauma
25	187857	53	M	Roentgenogram	Exploratory laparotomy for gastric ulcer; postoperative diagnosis gastritis; preoperative chest film pulmonary emphysema	Non-contributory	Yes	Right	Recovery	P.I.E.
26	535344	53	M	Roentgenogram	Carcinoma esophagus; esophago-gastrostomy	Dysphagia	Yes	Left	Recovery	Surgical trauma
27	520006	30	M	Roentgenogram	Exploratory thoracotomy for mediastinal tumor (substernal carcinoma thyroid)	Non-contributory	Yes	Yes	Recovery	Surgical trauma
28	372511	25	F	Roentgenogram	Splanchnicectomy with pleural tear	Hypertension	Yes	Left	Recovery	Surgical trauma
29	368388	21	M	Roentgenogram	Splanchnicectomy with pleural tear	Hypertension	Yes	Left	Recovery	Surgical trauma
						Traumatic Group				
30	201583	44	F	Roentgenogram	Dilatation of trachea by bronchoscopy (perforation)	Pulmonary, laryngeal tuberculosis (stenosing)	Yes	Artificial	Mediastinal emphysema subsided; died 3 yr. later tbc.	Direct trauma
31	391678	57	F	Roentgenogram, postmortem	Esophagoscopy (carcinoma esophagus); perforated diverticulum hypopharynx	Non-contributory	Yes	No	Died 5 days deep cervical abscess	Direct trauma
32	489755	4 days	M	Roentgenogram	Diagnostic jugular puncture (perforated trachea)	Cyanosis, wheeze since birth	Yes	No	Recovery	Direct trauma
33	468492	7 days	F	Fluoroscopy, postmortem	Diagnostic jugular puncture (perforated trachea)	Normal birth	Yes	Bilateral	Died 2 hr. complications atelectasis, mediastinal emphysema	Direct trauma
34	540163	62	M	Roentgenogram	Carcinoma esophagus, perforation during esophagoscopy	Dysphagia 5 mo.	No	No	Recovery from perforation, mediastinal emphysema	Direct trauma
35	539959	60	M	Clinically and roentgenogram	Carcinoma esophagus, perforation during esphagoscopy	Regurgitation 2 mo.	Yes	No	Recovery from perforation, mediastinal emphysema	Direct trauma
36	542739	3	M	Roentgenogram	Hit by automobile, fracture 1st, 2d ribs left; linear fracture left frontal bone	Non-contributory	Yes	Tension pneumothorax right; small pneumothorax left base	Recovery	Direct trauma
						Infectious Group				
37	285499	18	M	Clinically and roentgenogram	Asthmatic attack; admitted because of "crackling in jaw"	Asthma since child	Yes	No	Recovery	P.I.E.
38	195117	12	M	Clinically and roentgenogram	Asthmatic attack; admitted because of subcutaneous crackle	Asthma, hay fever, 2 yr.	Yes	No	Recovery	P.I.E.
39	76333	14	M	Roentgenogram	Asthmatic attack; admitted because of subcutaneous crackle	Asthma since childhood	Yes	No	Recovery	P.I.E.
40	417296	3	F	Roentgenogram	Asthma, fever, cough, dyspnea 2 days	Asthma, frequent colds	Yes	No	Recovery	P.I.E.
41	343506	10 mo.	M	Roentgenogram	Bronchopneumonia; atelectasis, mediastinal emphysema demonstrated pretracheotomy by roentgenogram	Numerous colds	No	Bilateral	Died 6 hr. post-tracheotomy, bronchopneumonia	P.I.E.
42	469410	6 mo.	F	Roentgenogram	Fever, atelectasis, cough 4 days	Non-contributory	No	No	Recovery	P.I.E.
						Newborn Group				
43	96999	NB	M	Postmortem	Intrauterine infection	Poor condition at birth	Yes	No	Died 1 day bronchopneumonia	P.I.E.
44	96481	NB	F	Postmortem	Intrauterine infection	Poor condition at birth	Yes	No	Died 1 day bronchopneumonia	P.I.E.
45	356084	NB	F	Postmortem	Fever, cyanosis, atelectasis	Difficult delivery	No	No	Died 20 hr. bronchopneumonia	P.I.E.
46	290486	NB	F	Postmortem	Dyspnea, cyanosis	Difficult delivery	No	Left	Died 10 hr. intracranial hemorrhage	P.I.E.
47	351907	NB	F	Roentgenogram	Cyanosis, atelectasis	Difficult delivery	No	Left	Recovery	P.I.E.
						Spontaneous Group				
48	386187	NB	F	Roentgenogram	Spontaneous	Cesarean section, good condition at birth, cried spontaneously; no respiratory distress	No	Small, right	Recovery	P.I.E.
49	211580	23	M	Clinically	Spontaneous	None	No	Yes	Recovery	P.I.E.
50	78540	30	F	Clinically and roentgenogram	Spontaneous	Non-contributory	Yes	No	Recovery	P.I.E.

* P.I.E. = Pulmonary interstitial emphysema.

sections of the lungs revealed extensive interstitial emphysema and the rupture of several bullae through the pleura. It was also interesting to note that the adventitia of many of the vessels and bronchi was

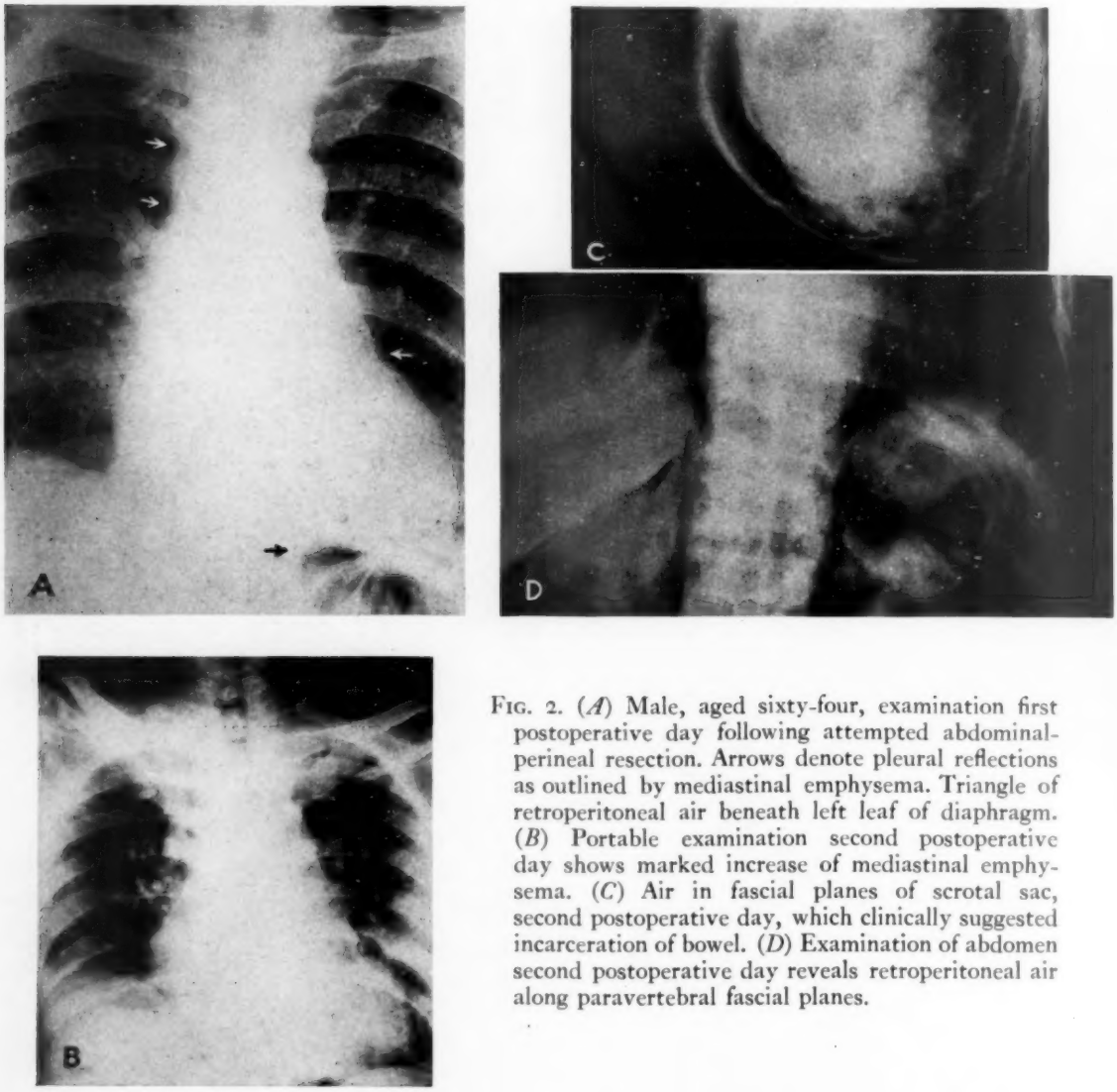

FIG. 2. (*A*) Male, aged sixty-four, examination first postoperative day following attempted abdominal-perineal resection. Arrows denote pleural reflections as outlined by mediastinal emphysema. Triangle of retroperitoneal air beneath left leaf of diaphragm. (*B*) Portable examination second postoperative day shows marked increase of mediastinal emphysema. (*C*) Air in fascial planes of scrotal sac, second postoperative day, which clinically suggested incarceration of bowel. (*D*) Examination of abdomen second postoperative day reveals retroperitoneal air along paravertebral fascial planes.

separated by the presence of air. The pre-operative chest film in this case, in addition to the minimal fibrocalcific infiltration at both apices, showed generalized interstitial fibrosis and marked pulmonary emphysema, factors which Macklin has shown to be conducive to rupture of alveolar bases.

Case 19 occurred within ten days of the preceding case and was remarkably similar in many respects. This was a white male, aged sixty-four, who had a carcinoma of the rectosigmoid. An abdominal-perineal resection was attempted but the lesion could not be removed. The operation was prolonged and was performed under intratracheal cyclopropane anesthesia. This patient also had marked pulmonary emphysema on the pre-operative chest film. On the first postoperative day a portable chest film revealed a small triangular collection of air inferior to the leaf of the left diaphragm. The following day a tense swelling of the scrotum was noted which, since the patient

had a known inguinal hernia, was thought to be an incarceration. Portable roentgen examination of the chest and abdomen on this same day, however, revealed mediastinal emphysema and also air in the retroperitoneal fascial planes. A roentgenogram of the scrotum showed that what was first thought to be incarceration of an inguinal hernia was emphysema of the scrotal tissue (Fig. 2, *A*, *B*, *C*, *D*). The patient did poorly and died on the ninth postoperative day. Permission for postmortem examination was not granted.

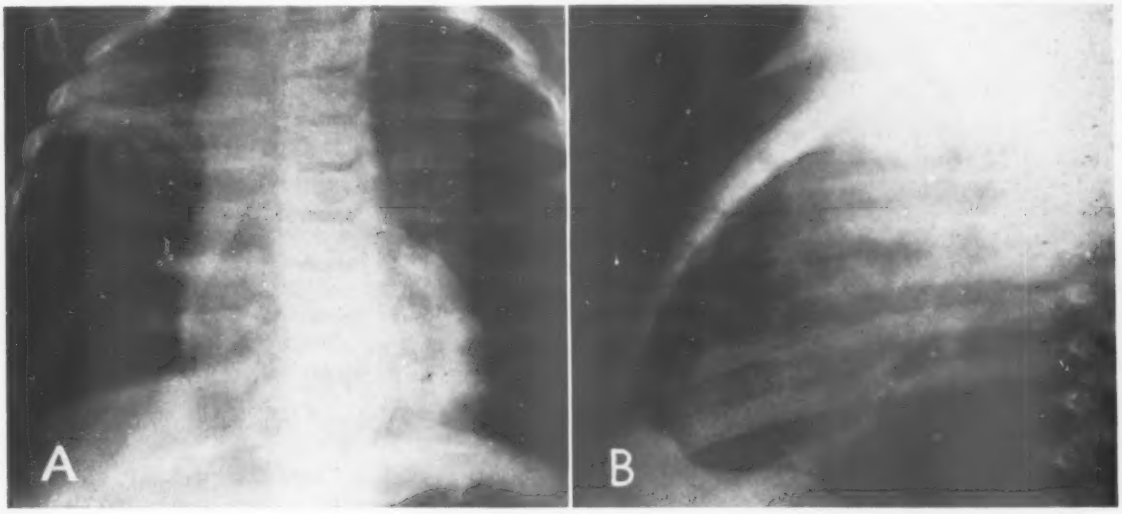

Fig. 3. (*A*) Infant, aged six months; fever and cough, four days. Note consolidation and partial atelectasis in the right upper lung and the globular collection of air superimposed on the cardiac shadow. (*B*) The left lateral projection localizes this collection of air to the anterior mediastinum. Note also distention of presternal soft tissues with subcutaneous emphysema.

In considering these 2 cases, it is apparent that it is the responsibility of the anesthesiologist to realize the potentialities of a combination of factors that might produce mediastinal emphysema of a malignant type. Positive pressure on the early inspiratory phase is used in both an "assisted" form, in which respiration maintains its own rate, and in "controlled" respiration in which the anesthetist establishes the rate. This is regulated carefully at about 10–12 mm. Hg. on inspiration with a drop to zero on expiration. If positive pressure is maintained during both phases (pushing against the expiratory phase), there is danger of producing mediastinal emphysema. The usual indication for exceeding 10–12 mm. Hg. pressure is in the reinflation of the lung in surgery involving the open thorax. Here 20–25 mm. Hg. may become necessary and there is a possibility of rupturing alveolar bases and thus starting the series of events leading to pneumomediastinum. Of course the significance of such an occurrence assumes much more importance with the knowledge of previous disease in the lungs (fibrosis, blebs, evidence of bronchostenosis). The surgeon may be forewarned of the danger in such cases by the anesthetist who uses increased pressures.

Mediastinal emphysema occurred as a complication during an asthmatic episode in 4 patients (Cases 37–40) in one of which there was also a unilateral pneumothorax. All made uneventful recoveries.

Case 42 (Fig. 3, *A* and *B*) is a good clinical example of one of the mechanisms of production of mediastinal emphysema, shown by Macklin to occur experimentally; namely, the creation of a pressure gradient between alveolus and vessel sheath as the result of atelectasis of a portion of lung.

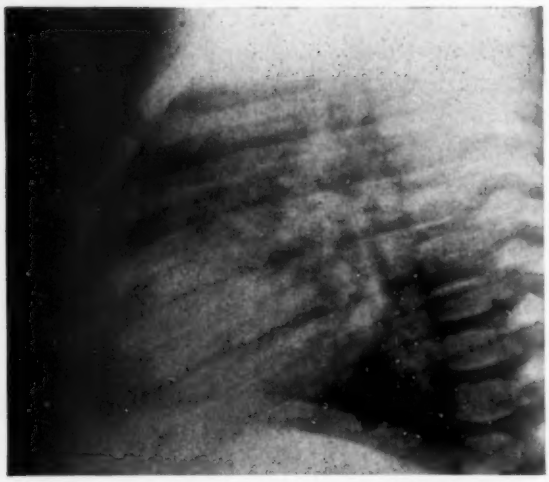

FIG. 4. Left lateral examination prior to tracheotomy (Case 41) demonstrates an anterior collection of air in the mediastinum not visible in the posteroanterior view.

In this instance the pneumonic inflammatory reaction induced partial atelectasis of the right upper lobe and this in turn initiated pulmonary interstitial emphysema.

Ten cases of mediastinal emphysema occurred in tracheotomized patients. In only 4 of the 10 cases do we have chest films prior to the tracheotomy. Case 41 was a male infant, aged ten months, admitted to the hospital because of stridor, cough and retracting of sternum. Five days after admission, due to increasing obstruction of the airway, tracheotomy was performed. Six hours following this procedure the patient died. Postmortem examination revealed numerous air bubbles in the anterior and posterior mediastinum, a left pneumothorax, bronchopneumonia, and atelectasis of the left lower lobe. A review of the pretracheotomy chest film in this case disclosed, on the lateral projection (Fig. 4) the presence of a small amount of air in the anterior mediastinum which was not visible on the posteroanterior view. This would therefore lend support to Macklin and Macklin's[21] contention that in many instances mediastinal emphysema in tracheotomized patients is incidental to the tracheotomy and that the precipitating factor is the obstruction to the airway necessitating the tracheotomy. In Case 3, the pretracheotomy chest films showed no evidence of mediastinal emphysema; however, roentgenograms of the chest (Fig. 5, *A* and *B*) taken a few hours following tracheotomy revealed the presence of air in the mediastinum. These cases demonstrate that mediastinal emphysema com-

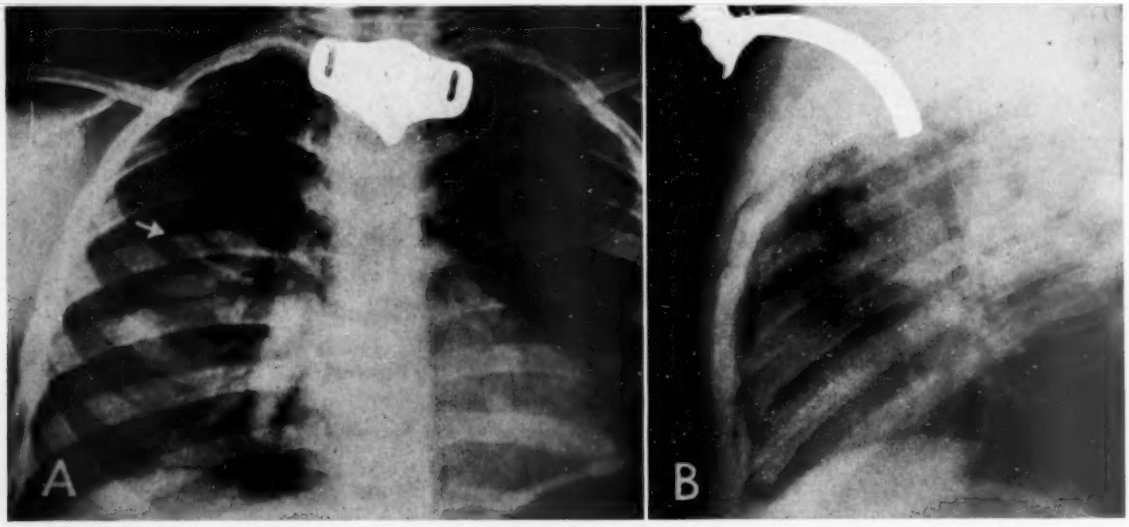

FIG. 5. (*A*) Infant, aged four, whose pretracheotomy roentgenograms showed no mediastinal emphysema. Note air outlining right hilar structures and pleural reflection on the right (arrow). Pneumothorax is also seen (white arrow). (*B*) Right lateral projection reveals radiolucent streaking throughout mediastinum and presternal subcutaneous emphysema.

plicating tracheotomy can occur not only, as Macklin and Macklin contend, as the result of interstitial emphysema, but also as Forbes *et al.* have shown by direct extension along the fascial planes of the neck. We believe that all cases in which tracheotomy is indicated should have preoperative chest roentgenoscopy or roentgenographic examination in order to exclude the presence of mediastinal emphysema.

The importance of proper size and placing of the tracheotomy tube was demonstrated in several of our tracheotomized patients. In a few cases disproportion between the size of the tube and trachea necessitated removal and re-insertion. If the tube is too large or too long, causing angulation or buckling of the trachea, partial obstruction to the airway results. This in itself may well precipitate the chain of events leading to interstitial and mediastinal emphysema. If the tube is too small, air leaks occur about the wound causing troublesome subcutaneous emphysema and respiratory embarrassment. Air leaking into the tissues about a poorly fitting tube may dissect its way along the precervical fascial planes to the mediastinum. Careful attention, therefore, to proper size of the tube with its position checked by roentgen examination will help to prevent some of the undesirable and potentially dangerous complications of tracheotomy.

Cases 32–33 are interesting in that mediastinal emphysema developed following diagnostic puncture of the external jugular vein. In both of these newborn infants the trachea was lacerated during the venipuncture, with the immediate occurrence of subcutaneous emphysema. Case 33 died two hours following this accident and postmortem examination revealed puncture marks in the trachea. There was massive mediastinal emphysema; the mediastinal pleura was markedly overdistended and there were large emphysematous bullae in the mediastinal tissues. A bilateral pneumothorax was present and both lungs were collapsed. There was no evidence of obstruction to the trachea or bronchi. This is an example of malignant mediastinal emphysema with rapid fatal termination. The other of these 2 cases (Fig. 6, *A* and *B*) was shown to have mediastinal emphysema on a chest roentgenogram taken immediately following the venipuncture. This case, however, made an uneventful recovery.

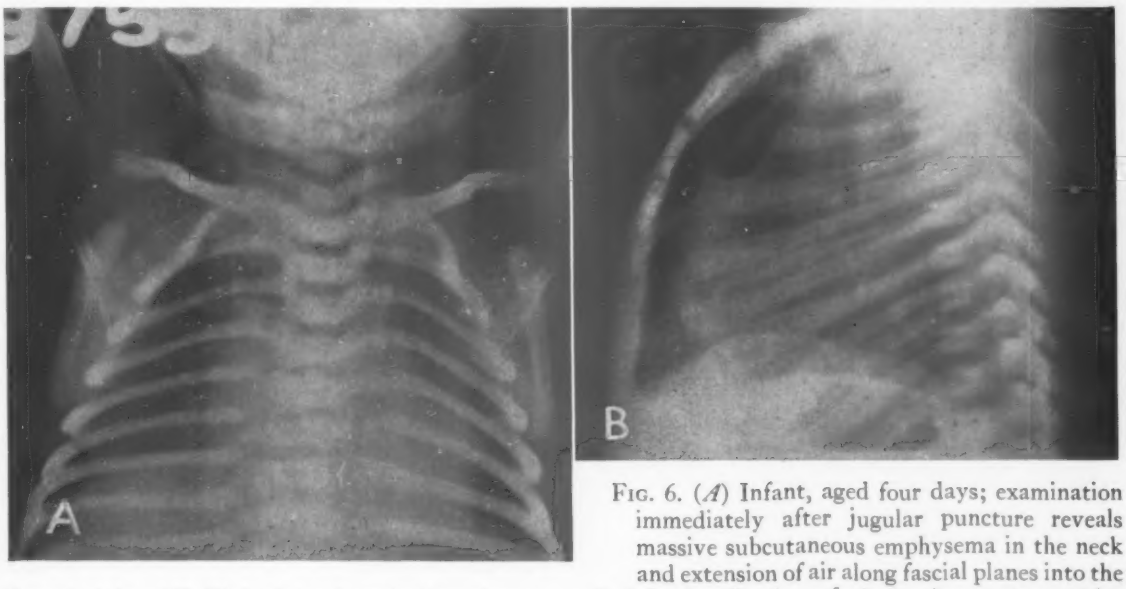

Fig. 6. (*A*) Infant, aged four days; examination immediately after jugular puncture reveals massive subcutaneous emphysema in the neck and extension of air along fascial planes into the thoracic inlet. (*B*) Right lateral projection shows a well defined collection of air in the upper anterior mediastinum.

There are but few case reports of pneumothorax of the newborn in the literature[3,8,11,14,29,32,35,36] and fewer still of pneumomediastinum.[9,15,34] In our series there were 6 cases of mediastinal emphysema in full-term newborn babies with 4 deaths. All 4 deaths occurred within twenty-four hours of delivery and postmortem examination in each case revealed bronchopneumonia, atelectasis, pulmonary interstitial emphysema and mediastinal emphysema. Case 43 was a spontaneous delivery but there was a history of intrauterine infection, the infant was cyanotic and in such poor condition at birth that a respirator was necessary. Death occurred within a few hours. In Case 44 there was also a history of intrauterine infection; the baby was in poor condition at birth and showed evidence of laryngeal asphyxia. A respirator was required. The postmortem findings in this case, in addition to the pulmonary pathology, also revealed hemorrhage in the ventricles of the brain. Case 45 was a spontaneous delivery after a difficult labor. The infant was cyanotic and on examination there were crackling rales over the right chest posteriorly and there was retraction of the sternum. Death occurred twenty-four hours after delivery and at autopsy there were large blebs of air in the mediastinum, bronchopneumonia, and atelectasis. Case 46 was a prolonged and difficult labor. The infant was stated to have been in fair condition at birth but died ten hours later. Autopsy, in addition to the pulmonary findings, revealed subtentorial hemorrhage. Case 47 had a five hour labor and low forceps delivery. Condition at birth was stated to be good. Cyanosis appeared ten hours postpartum at which time there was clinical evidence of atelectasis and pneumothorax. Roentgen examination of the chest showed bilateral atelectasis, left pneumothorax, and in the lateral view revealed air in the anterior mediastinum. Eight days postpartum the left lung had re-expanded and the infant made an uneventful recovery.

Case 48 was a full-term cesarean section. The infant was extracted by the breech, cried spontaneously and appeared in good condition. There was no evidence of respiratory distress. On the second neonatal day a chest roentgenogram was taken for "question of cardiac size." This revealed a very small pneumothorax at the right base and moderate mediastinal emphysema, the emphysema being confined to the anterior mediastinum. This case has been classified as one of spontaneous mediastinal emphysema and pneumothorax in the newborn as there was neither clinical nor roentgenological explanation for its occurrence.

The term spontaneous mediastinal emphysema, it would appear, needs further clarification. We feel, as does Draper,[7] that the term has been loosely applied and agree with his definition of "spontaneous" as that "arising without apparent cause in presumably healthy individuals in whom no underlying pathologic condition is subsequently demonstrated." Cases 49 and 50, we believe, fit this definition and have been classified under this grouping. Case 49 was a medical student, aged twenty-three, who consulted the student health service because of mild chest pain. On examination there was evidence of a small pneumothorax at the left apex and the presence of those characteristic extracardiac sounds which have become known as Hamman's sign. There was no history of recent illness, physical exertion or effort. Past history was negative for any similar complaints. Hospitalization was not considered necessary and he was allowed to continue at classes. A roentgenogram of the chest at the time he consulted the student health service was reported as showing a left apical pneumothorax. There was no mention of free air in the mediastinum although the roentgen report called attention to the recent publication of a similar case by Morey and Sosman.[28] The chest discomfort and pneumothorax soon disappeared. Subsequent chest roentgenograms showed no evidence of pulmonary disease. Four years following this episode there had been no recurrence.

Case 50 was that of a female hospital

clerk, aged thirty, who, while on vacation, suddenly awoke one morning with acute respiratory distress. She had been in good health and completely asymptomatic until the sudden onset of acute dyspnea. On admission to the hospital forty-eight hours later she was in acute respiratory distress. She had a severe cough, paroxysmal in nature and productive of frothy white sputum. Soon after onset of symptoms she began having sharp pain over the lower sternum when coughing. The cough later became wheezing in character. The past history was not contributory. There was no history of asthma or hay fever and no history of cardiac disease. Examination revealed a well developed and well nourished white female in acute respiratory distress with asthmatic type of breathing. There was evidence of subcutaneous emphysema of anterolateral aspect of the neck and over the left anterior chest wall. Percussion note was hyperresonant over the anterior part of the chest. There was expiratory prolongation with wheezing over the entire chest and coarse rales at the left base. Roentgen examination of the chest on admission showed reflection of the left mediastinal pleura which was plainly visible as a thin, white line extending from the arch of the aorta to its pericardial attachment (Fig. 7*A*). On the lateral view there was seen to be free air in the anterior mediastinum and vertical air streaks in the superior mediastinum extending through the thoracic inlet with dissection along the precervical fascial planes (Fig. 7*B*). On the fifth hospital day roentgen examination revealed absorption of the mediastinal and subcutaneous emphysema.

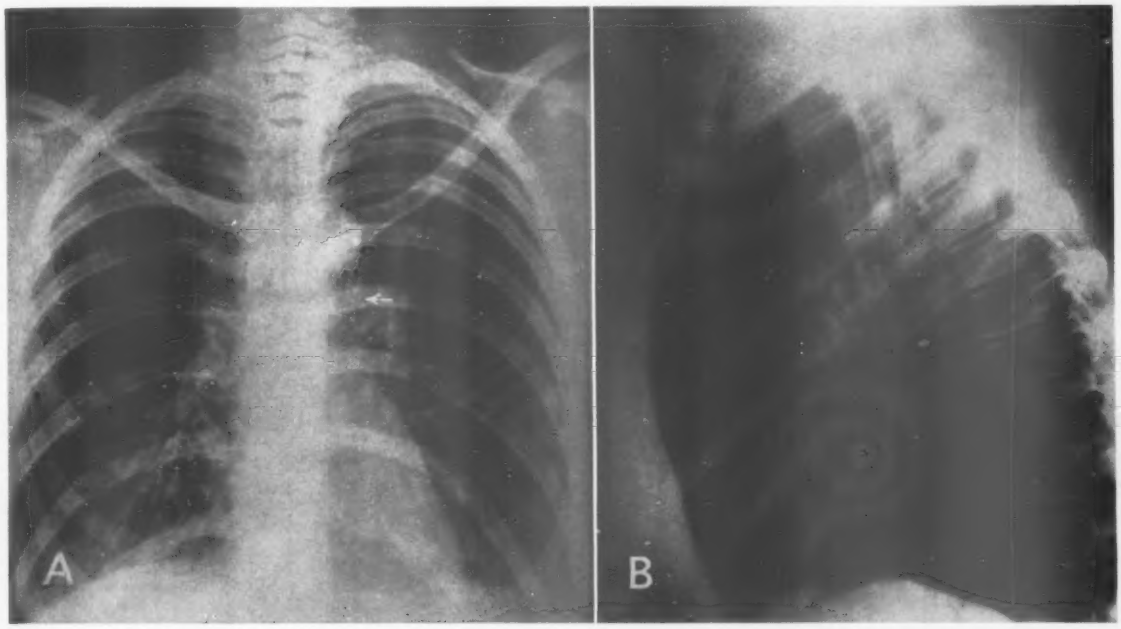

Fig. 7. (*A*) Spontaneous mediastinal emphysema, female, aged thirty. Arrow points to left mediastinal pleura. Its superior attachment to the arch of the aorta is plainly visible. (*B*) Lateral view showing collection of air in anterior mediastinum and vertical radiolucency in superior mediastinum.

The symptoms and signs of mediastinal emphysema are the result of "airblock." Pain may be mild or severe, substernal, precordial, or may radiate across the chest to the shoulder and down the arm. As has been stated, it may very closely simulate coronary disease. Dyspnea and cyanosis are the result of increased mediastinal tension. Cardiac dullness may be obliterated. The presence of air in the tissues over the heart produces a characteristic crunching sound with each heart contraction, the

FIG. 8. Left lateral projection in case of mediastinal emphysema showing air surrounding aorta and major pulmonary vessels and outlining their margins with unusual clarity.

so-called "Hamman's sign." Subcutaneous emphysema without apparent cause is pathognomonic of mediastinal emphysema.

To better understand the roentgen appearance of air in the mediastinum it might be well to briefly review the important attachments and reflections of the mediastinal pleura. The mediastinal pleura covers the lateral surfaces of the mediastinum and the structures therein. It is continuous with the pulmonary pleura around the root of the lung. Inferiorly it is continuous with the diaphragmatic pleura at the base of the pericardium. Above the root of the lung the pleural reflection passes from the sternum to the vertebral column. In this region the left mediastinal septum is applied to the arch of the aorta which is usually at the upper border of the second chondrosternal articulation.

The right mediastinal pleura is applied to the upper part of the superior vena cava and is at the level of the first rib. Below and in front of the root of the lung the mediastinal pleura clothes and is attached to the pericardium.[6]

Ehrenberg[8] has made an interesting observation in cases of artificial pneumothorax where there is unilateral bulging of the mediastinum which is interpreted as herniation of the mediastinum. He states that if roentgenograms are taken in the ex-

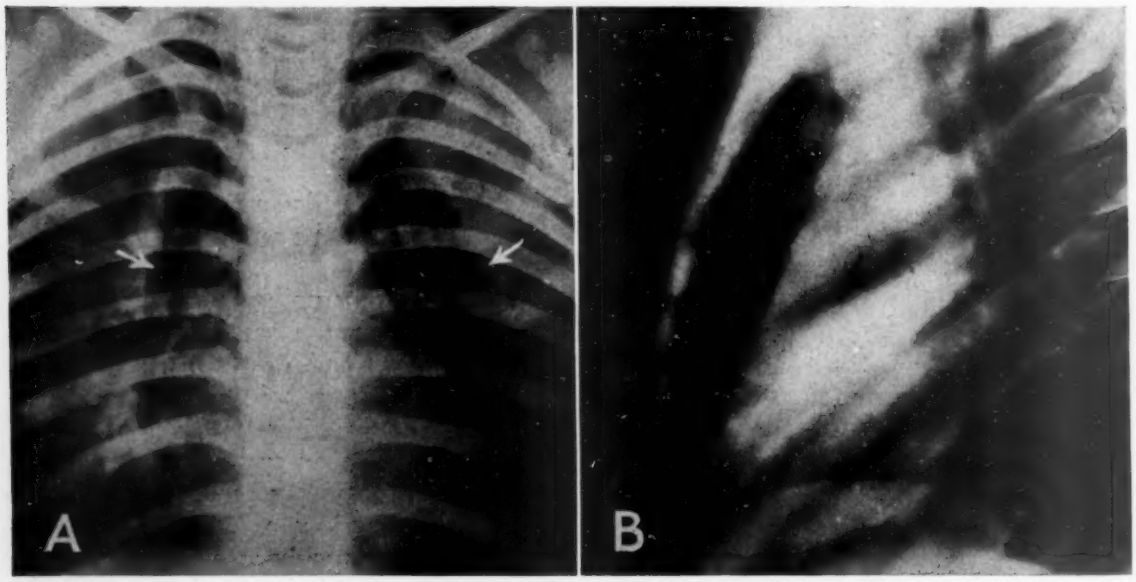

FIG. 9. (*A*) Child, aged three, whose roentgen examination following an asthmatic attack, revealed massive mediastinal emphysema. Note marked degree of bulging bilaterally of mediastinal pleura (arrows). (*B*) Right lateral projection reveals a large collection of air in the anterior mediastinum.

piratory phase, frequently bilateral bulging of the mediastinal septa will be seen indicating the true nature of the bulging as mediastinal emphysema.

In the roentgen examination of the patient suspected of having pneumomediastinum the usual posteroanterior view may be of little help in establishing the diagnosis since the presence of air behind the sternum may be obscured by the bony structures anteriorly. Lateral or oblique views are therefore essential in detecting the presence of air in front of or behind the heart and also in the superior mediastinum where air can be seen surrounding the arch of the aorta, pulmonary arteries and other major supracardiac vessels, making it possible to identify these structures with unusual clarity (Fig. 8). Air in the mediastinum may be recognized in the posteroanterior roentgenogram as a thin, sharply

FIG. 10. Note mediastinal emphysema outlining left mediastinal pleural reflection (arrow).

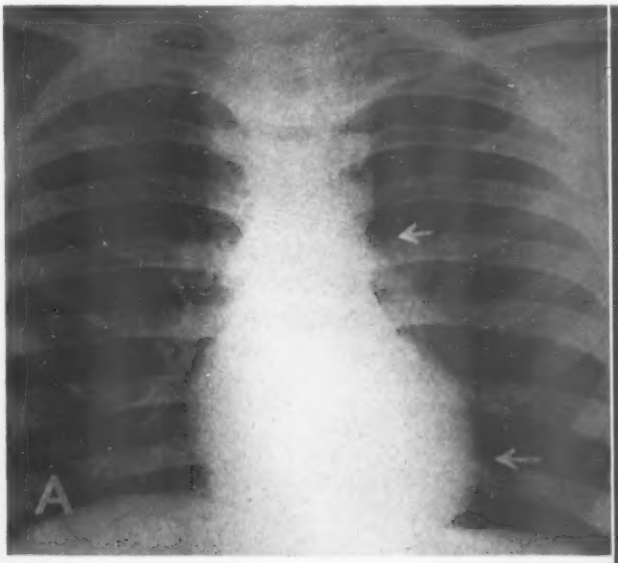

FIG. 11. (*A*) Case 39, boy, aged fourteen, admitted in asthmatic attack. Roentgen examination following admission reveals, in posteroanterior view, radiolucent streaks throughout superior mediastinum. Bulging of the left mediastinal pleura is plainly visible (upper arrow); also narrow radiolucent band adjacent to lower left cardiac border. (*B*) Lateral projection shows vertical translucent streaks of air in anterior and posterior mediastinum. Note also cervical subcutaneous emphysema and marked distention of superficial presternal tissues with air.

FIG. 12. Case 14, infant, aged four months; roentgenogram immediately after thymectomy demonstrates globular radiolucency superimposed on the cardiac density. The mediastinal pleura was opened during the operative procedure and at the end of the operation some air was aspirated from the mediastinum. The roentgen findings here are similar to those in Case 42 (Fig. 3, *A* and *B*) whose lateral roentgenogram demonstrated an anterior collection of mediastinal air.

defined band of translucency outlining the pericardium. With fairly large amounts of air in the mediastinum, there may be evident bulging of this structure with lateral displacement of the lungs (Fig. 9, *A* and *B*). The mediastinal septum on one or both sides may be easily distinguished as a thin, sharply defined line extending on the left from the arch of the aorta to its pericardial attachment, whereas on the right it is seen extending from the first chondrosternal articulation to the pericardium (Fig. 2*A* and 10). Superior mediastinal air in the posteroanterior view is seen as translucent, vertical streaks and blotches representing collections of air around the sheaths of the supracardiac vessels and mediastinal fascial planes (Fig. 11, *A* and *B*). Cases 14 and 42 presented an unusual appearance and pattern of air in the posteroanterior roentgenogram. The mediastinal air in both of these cases is confined to the anterior mediastinal space and assumes a flask-like radiolucent configuration superimposed on the cardiac density (Fig. 3*A*, and 12). This might be mistaken for air in the pericardium except for the lateral view which separates the anterior collection of air from the cardiac shadow (Fig. 3*B*).

SUMMARY

This paper presents a discussion of the mechanisms of production of mediastinal emphysema, the significance of this disorder in the various clinical situations in which it occurs, and roentgen features of typical examples selected from a series of fifty cases collected at The New York Hospital.

Emphasis is placed on the importance of perialveolar and perivascular extension as demonstrated by Macklin and Macklin in evaluating dyspnea and cyanosis in cases of acute pulmonary infection, in asthmatics, in the newborn, and in postoperative cases where trauma to pleura or extension of air from operative site to mediastinum seems unlikely. Posteroanterior roentgenograms may demonstrate one or both mediastinal pleural reflections or may reveal a globular radiolucency superimposed on the cardiac shadow. It is the lateral projection, however, which in the majority of cases is the most revealing in outlining mediastinal collections of air.

After operation, trauma to the chest, and in cases of spontaneous chest pain, dyspnea and cyanosis should arouse suspicion of the presence of mediastinal emphysema. These signs and symptoms following operative procedures are usually considered to be due to the shock of the operation, some pulmonary complication, or sequelae of the anesthesia, and it is only when subcutaneous emphysema appears that the real nature of the condition is considered. Early recognition is therefore imperative if prompt corrective measures are to be instituted.

Several other points are made: (1) The relationship of pneumomediastinum to pneumothorax and subcutaneous emphysema; (2) the value of roentgen examination of the chest before tracheotomy to rule

out mediastinal emphysema as the cause of extreme dyspnea and cyanosis; and (3) the importance of early roentgen diagnosis in order to prevent the development of so-called "malignant" pneumomediastinum which may be fatal.

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DISCUSSION

DR. LEO G. RIGLER, Minneapolis, Minnesota. The presentation you have just heard aroused my enthusiasm as the essayists have exposed this subject in such comprehensive fashion. After reading their complete paper, a summary of which Dr. Evans presented here, I find little that I can add and nothing that I can disagree with.

Perhaps I might lay emphasis on certain features which they could not fully clarify in the time available. I am glad that Dr. Evans emphasized the importance of lateral views. I suspect that a good many cases of this type are missed because of our habit of taking only posteroanterior and anteroposterior views especially in sick patients that we do not want to move about.

There is one other point in technique, I think, that should be emphasized, something I have talked about many times, and I think some of Dr. Evans' slides brought it out very well; namely, the importance of over-exposure in anteroposterior views when trying to see something in the central shadow of the thorax. At this point, the density is such that, unless one makes a heavy exposure, such shadows as he has shown, the linear streaks and areas of increased radiability, may be completely lost in this density.

There is one question that arises in my mind. Most of us have seen a fair number of cases of spontaneous or idiopathic pneumothorax. We see these frequently in what are apparently healthy young students who have no promonitory symptoms or signs—yet I can recollect seeing only one such case of pneumomediastinum. Dr. Evans and Dr. Smalldon reported 3 apparently spontaneous cases without clear-cut etiological pattern. It would be interesting to know if they have opinions as to why there should be this difference.

It occurred to me that in some patients without any real, obvious pathology a spontaneous pneumomediastinum might occur but of such small extent as not to give the patient symptoms, and perhaps such cases are not coming in for examination.

One type of mechanism in the production of mediastinal emphysema, not mentioned by the authors, but certainly very similar to some of their other cases, may be of some interest. We saw a child who had had a Wilms' tumor removed and then developed extensive lung metastases. She was treated by irradiation. The metastases disappeared after treatment and then when we saw her, the child was quite ill with what appeared to be a typical and rather severe radiation pneumonitis. Following this, suddenly, cyanosis and extreme dyspnea appeared and roentgen examination at that time showed a very characteristic, extensive pneumomediastinum such as has been described here, which went on progressively to produce fatality in this particular case, no effort at control being successful at all. Obviously, the mechanism here is similar to that which has been mentioned; that is, some type of lung fibrosis with rupture of alveoli.

DR. EVANS (closing). I believe Dr. Rigler has himself answered the first question as I would have answered it and that is in the cases of spontaneous pneumomediastinum, the reason we do not detect it more frequently is due to the fact that they are probably very small and in all probability by the time we see them they might very well have been absorbed.

I was interested in noting that Dr. Dickey at the University of Wisconsin Health Service reported last year some 40 cases of spontaneous pneumothorax in which there was a very high incidence of pneumomediastinum; I believe something like 20 per cent of her cases. In none of the cases, however, was the air demonstrable in posteroanterior roentgenograms. They were all diagnosed clinically. I take this opportunity to thank Dr. Rigler for his discussion.

Vol. 64, No. 3

ENCEPHALOTRIGEMINAL ANGIOMATOSIS (STURGE-WEBER SYNDROME)

WITH PARTICULAR REFERENCE TO THE ROENTGENOLOGICAL ASPECTS BEFORE AND AFTER NEUROSURGERY

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PHOENIX, ARIZONA

THE probable association of a "port-wine mark" on the face, ipsilateral congenital glaucoma and contralateral jacksonian convulsions was first postulated by Sturge[15] in 1879.

Characteristic calcifications within the skull were originally described by Weber[16] in 1922. These consist of sinuous, double contoured lines, which follow the convolutions of the cerebral cortex on the affected side. Roentgenograms of the skull disclose these findings in varying degrees in about 80 per cent of the cases (Schwartz[14]), being most commonly located in the parietal or occipital areas. Pneumoencephalography may emphasize an asymmetry of the skull and localized atrophy of the brain with unilateral dilatation of a portion of the lateral ventricle. Cerebral angiography has been suggested (J.R.G.[9]) to have diagnostic value in certain cases even in the absence of calcification.

The localization of such intracranial calcification was assumed to be in the leptomeninges until histopathological studies made by Krabbe[11] revealed (1) atrophy of the affected lobe, (2) vascularized and angiomatous meninges and (3) calcifications of various shapes and sizes, occurring mostly in the second and third laminae of the affected cortex. These studies have been elaborated by Bergstrand, Olivecrona and Tönnis[2] and others. The epileptogenic properties of these lesions have been discussed by Alexander and Woodhall.[1]

We have recently had the opportunity to observe and treat a small girl with such a condition. She had been having up to fifteen convulsive seizures daily in spite of adequate medical management. A remarkable correlation of the clinical, roentgenological and electroencephalographic features before and after neurosurgical removal of the epileptogenic area is presented.

CASE REPORT

History. D.D. was eight years of age at the time of her admission to St. Monica's Hospital, Phoenix, Arizona, on February 10, 1949. She was referred to one of us (J.R.G) by Dr. Otto L. Bendheim of Phoenix because of unmanageable convulsive seizures.

The family history disclosed that both parents and a younger sibling were living and well. The only neuropsychiatric determinant in the family history of possible significance was that the child's maternal great-grandmother died at the State Hospital of some undetermined type of insanity. There was no history of "birthmarks."

Past History. The mother's pregnancy was normal. Her delivery occurred in the home after thirty hours of labor; no forceps were required. Because of prolapse of the umbilical cord, it had to be cut before the child was completely delivered. The baby was cyanotic following delivery and "did not cry for thirty minutes." Examination at birth revealed a nevus over the right frontal region. The early development of the child was perfectly normal until the present illness.

Present Illness. At the age of eight months she was stricken with a sudden illness which began with cyanosis and rigidity, followed by unconsciousness, elevated temperature and hyporeflexia of the left extremities of ten days' duration. Blood and spinal fluid examinations were made. A question of encephalitis was raised. There was residual, temporary paralysis of the left leg and left ocular muscles. The child recovered from this illness, but for the next

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three years she continued to have attacks of rather severe drowsiness which gradually increased to the proportions of unconsciousness with complete flaccidity of all extremities. These attacks would last from a few minutes to half an hour, except on one occasion when an attack persisted for several days. The child could not be aroused from this stupor, but when she awoke spontaneously she appeared to be normal. When she was four or five years of age the nature of the attacks changed to seizures characterized by sudden spasticity, rigidity and stiffening of the entire body, frequently accompanied by a fall, complete unconsciousness

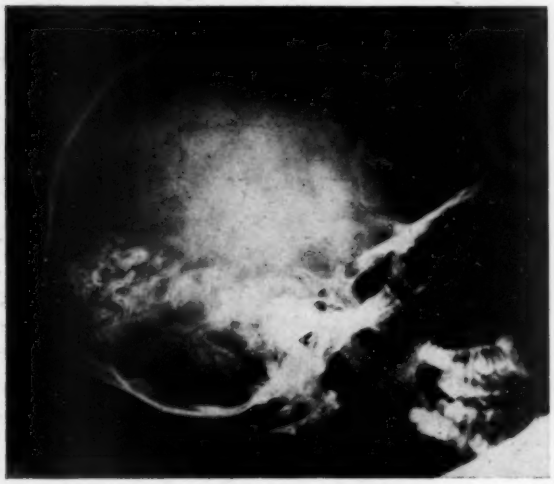

FIG. 1. Preoperative roentgenogram of the skull, lateral view. Note extensive cortical calcification.

and certain muscular contractions. There was no tongue biting. Occasionally there was slight foaming at the mouth, respiratory embarrassment and in a few instances slight injury to the head and face in falling. There were no sphincter disturbances. In addition to these rather dramatic seizures, she experienced others while walking, playing, eating or engaging in other activities. These were heralded by the sudden onset of muscular contractions which involved her entire body and lasted only a few seconds. There was usually no fall or unconsciousness and when these occurred the loss of consciousness persisted for only a few seconds. The attacks ended as suddenly as they began and the child was able to continue with her activities. The number of seizures varied from one to fifteen per day. The child was not able to perform some of the usual activities of her age group such as catching ball and skipping rope.

The review of systems was non-contributory except for the history of measles accompanied by severe pneumonia which occurred at the age of two and one-half years and terminated spontaneously with no residual effects.

The patient consulted Dr. Bendheim on March 26, 1948. In addition to a large "port-wine mark" over the dermatome of the first division of the trigeminal nerve on the right

FIG. 2. Preoperative roentgenogram of the skull, Towne's position.

side, a defect in the left visual field was found. Phenobarbital and dilantin and later tridione, in various combinations, were prescribed with considerable benefit for nearly one year.

On February 8, 1949, the child was re-examined by Dr. Bendheim because of aggravation of the intensity and frequency of convulsive attacks. Ophthalmological consultation by Dr. Paul E. McFarland revealed no significant ocular findings other than a left homonymous hemianopsia.

Roentgenograms of the skull (Fig. 1 and 2) were made on February 8, 1949. The cranial vault was intact. There was no evidence of localized decalcification. The sella turcica was normal. The development of the cranial vault

in the occipital region appeared to be less marked on the right side than on the left. The posterior portion of the lateral sinus on the right side was elevated.

Within the cranial cavity in the region of the occipital lobe, resting on the lateral sinus, at the level of the tentorium cerebelli, a pyramidal shaped area was demonstrated showing extensive curvilinear calcification extending from the posterior aspect of the occipital lobe at its point of contact with the inner table, anteriorly, to a point just above the auditory canal. Anterior to this and posterior to the dorsum sellae, a single area of calcification was seen. Throughout the involved area the calcification took the form of sinuous, double contoured lines. The general effect of the wedge-shaped area was that of calcification outlining the sulci and gyri of the occipital lobe.

In anteroposterior projection, there was a sharp demarcation of the area of calcification medially, at the level of the falx cerebri. The inferomedial angle of the calcified area appeared to involve the region normally occupied by the occipital lobe.

The impression was that the findings were compatible with a diagnosis of cerebral angiomatosis (Sturge-Weber syndrome).

The patient was then referred for neurosurgical evaluation and treatment.

Physical and Neurological Examination. The child appeared to be pale and asthenic. She was active, sensitive and somewhat apprehensive. Her reaction time was normal and in general her mental status was that of a normal child. The blood pressure was 100/60. There was a large "port-wine mark" involving the right side of the head in the distribution of the trigeminal nerve (Fig. 3). This was purplish in color and blanched on digital pressure. It covered the bridge of the nose, following it up the midline to the vertex. The lateral border was considerably irregular. There were no other evidences of skin abnormality.

There was no obvious cranial asymmetry. Both palpebral fissures measured 10 mm. and were normal. There was no evidence of glaucoma. The cranial nerves were examined serially and were found to be normal. Examination of the optic fundi and visual fields, however, indicated a complete left homonymous hemianopsia. There was no evidence of angiomatous change of either retina.

The heart, lungs and abdomen were normal. The extremities were normally developed, symmetrical and showed no sensory or reflex changes. The blood and urine studies were entirely normal.

Electroencephalography on February 9, 1949, revealed a mixture of low voltage fast activity and 9½ to 10/second frequencies in all leads except the right parieto-occipital. In this area there was a slow wave focus of 4/second activity in the posterior parietal region on the right side suppressed down to almost no amplitude with associated negative spikes in the right occipital leads, most marked medially and best seen during periods of spontaneous sleep. There was a large build-up of amplitude with slowing in all leads following hyperventilation, but no aggravation of clinical or electroencephalographic changes.

Fig. 3. "Port-wine mark" of skin following the distribution of the first division of the right trigeminal nerve.

The impression was that of a very abnormal electroencephalographic study, indicating a large right occipital lobe focus of suppressed cortical activity associated with seizure discharges.

The child was admitted to St. Monica's Hospital, February 10, 1949, for removal of the epileptogenic focus. Craniotomy and right oc-

FIG. 4. Surgical specimen (occipital lobe).

cipital lobectomy was performed on February 11, 1949.

Neurosurgical Procedure. Under general anesthesia a six hole osteoplastic craniotomy over the right occipital region was performed. The leptomeninges of the occipital lobe appeared to be a bluish-red color suggesting capillary changes. The gyri were quite small and upon palpation were definitely hard. The greater portion of the right occipital lobe was amputated. The patient was returned to bed in good condition.

Surgical Pathology. The gross specimen (Fig. 4, 5 and 6) consisted of the major portion of the right occipital lobe measuring 5.5 by 5.0 by 3.0 cm. The gyri appeared smaller than normal. The dura presented no gross changes of significance. The leptomeninges were deep red in color, finely granular and hemorrhagic in some areas. The subarachnoid vessels were dilated and prominent. Along one surface, apparently the area which was severed from the remaining brain, the tissue was found to be irregular and granular.

Upon examining the cut surface, the convolutions were still discernible, but yellow sinuous lines following the course of the gyri were seen. These tortuous lines contained masses of calcific material as detected by scraping the knife blade across the cut surface. There were also a few small petechial hemorrhages scattered throughout the cortex.

The microscopic examination of the dura revealed that it was slightly thickened as a result

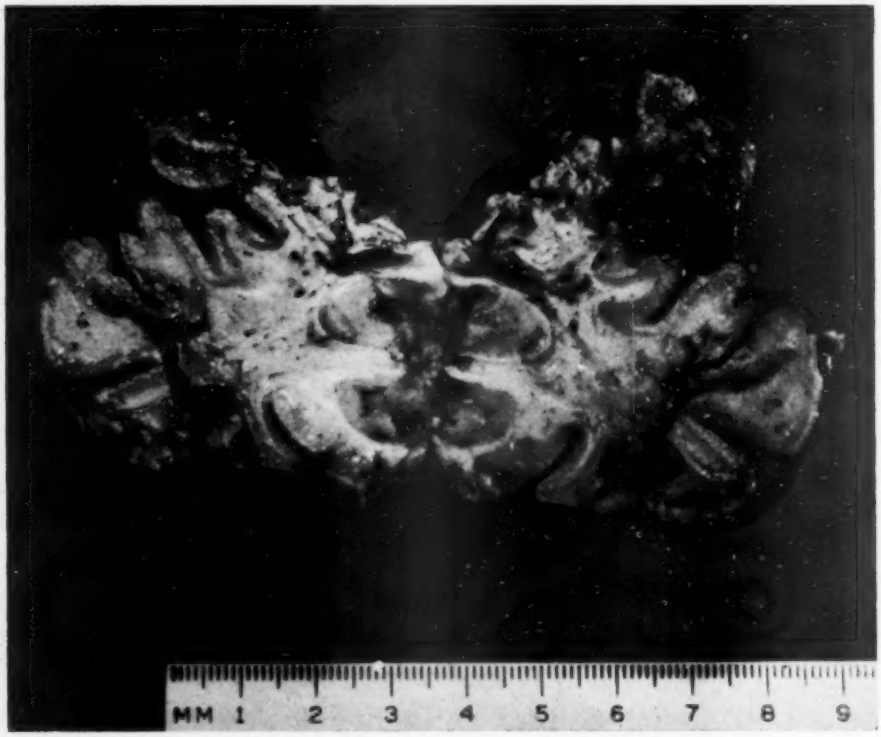

FIG. 5. Specimen in Figure 4 bisected. Note microgyri.

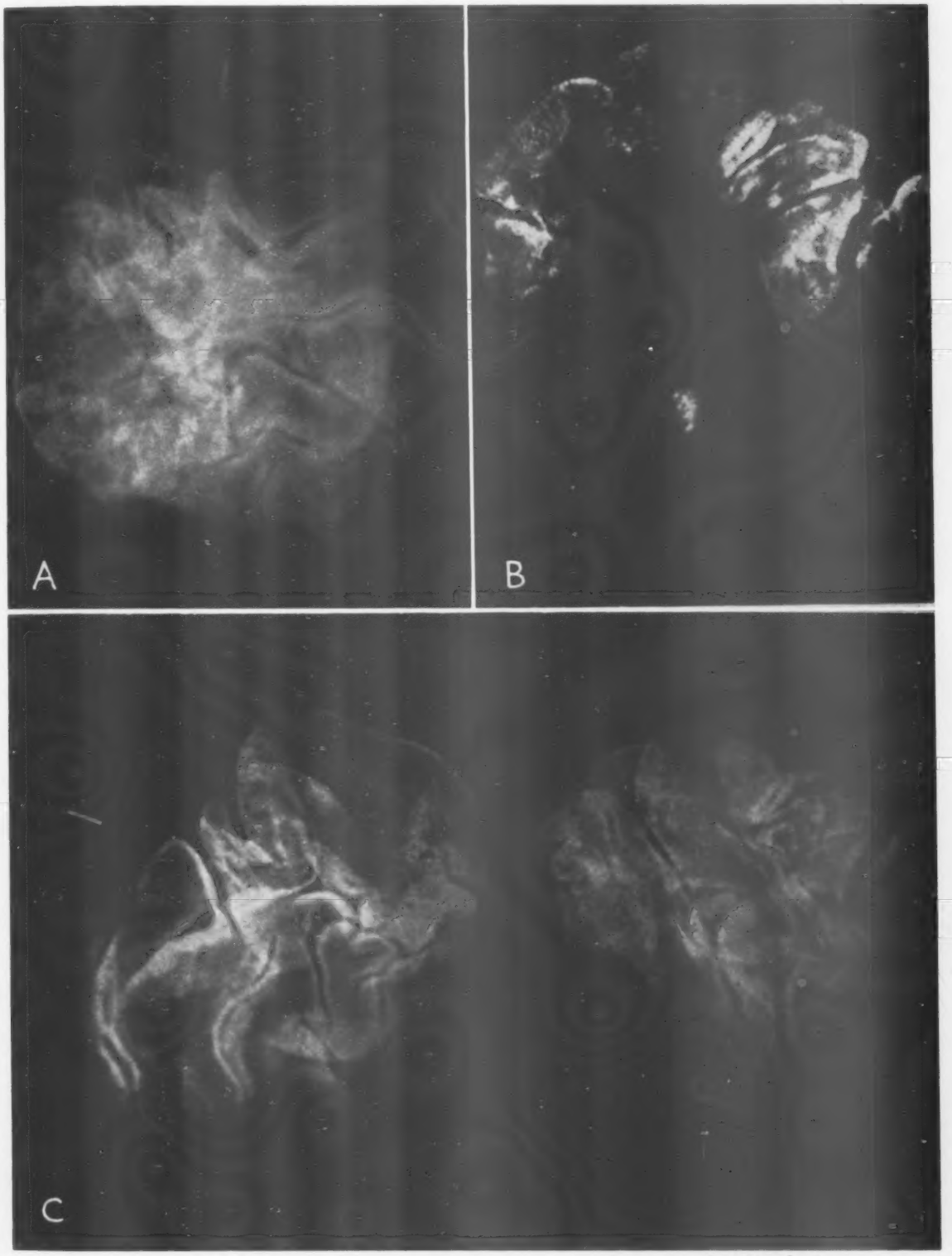

Fig. 6. (*A*) Roentgenogram of gross specimen. Compare with Figure 4. (*B*) Roentgenogram of thick section. Compare with Figure 7. (*C*) Roentgenogram of bisected specimen. Compare with Figure 5.

of fibrous tissue proliferation. An occasional small artery whose wall was infiltrated with a few polymorphonuclear leukocytes was seen. The lumen of some of the arteries contained thrombi. An occasional small focal hemorrhage was found in the substance of the dura. A few of the sinusoids were dilated and filled with red blood cells.

FIG. 7. Photomicrograph (×20). Note angiomatous vessels in leptomeninges and calcification in cerebral cortex.

The leptomeninges (Fig. 7) revealed an angiomatous malformation characterized by a collection of large blood channels which were cavernous in type. The larger ones presented a thin wall lined by a single layer of endothelial cells. The blood channels varied considerably in size and shape and many of them were filled with red blood cells. In the region of the angiomatous malformations, the pia and the arachnoid could not be differentiated. In some places, however, where the arachnoid membrane could be recognized, it was found to be slightly thickened, apparently as a result of connective tissue proliferation. In a few places where the subarachnoid space was recognizable, several large thick vascular channels, dilated and filled with red blood cells, were seen. The second and third layers of the cerebral cortex were almost completely replaced by deposits of a granular calcific material. These calcific deposits varied considerably in size and shape and staining capacity. They measured from 5 to 150 μ in diameter. The larger particles were found in the outer layers of the cortex and the smaller particles appeared to be concentrated in the inner layers. Many of the smaller granules were spherical in shape, laminated and resembled psammoma bodies. Occasionally, large focal deposits of the calciferous material presented a glial reaction along the margin of the lesions. Where the nerve cells were still discernible, they showed swelling and various regressive changes. However, no evidence of calcification in the nerve cells could be seen in the sections studied. An occasional small arteriole presented calcification of the media. In some sections, dilated capillaries and punctate hemorrhages were scattered throughout the inner layers of the cortex and white matter.

Postoperative Course. On the first postoperative day the patient had a light jacksonian motor seizure which lasted about thirty seconds and involved the left upper extremity. There were no signs of added motor or sensory involvement. Except for moderate headache her recovery was uneventful. The patient was discharged on the sixth postoperative day on a maintenance dose of phenobarbital and dilantin.

The patient was last seen on July 23, 1950. She had remained completely free of seizures, had been quite active and was able to catch a ball and skip rope which she could not do prior to surgery. She was doing well at school and leading a normal, happy life. Her medication consisted of phenobarbital, gr. ½ t.i.d. and dilantin, gr. 1½ t.i.d. The physical findings remained unchanged. The hemianopsia was of the same degree as formerly.

Roentgenograms of the skull demonstrated that the greater portion of the involved brain tissue had been removed. Residual areas of calcification were noted (Fig. 8 and 9).

Electroencephalography revealed a remarkable improvement and the impression was that

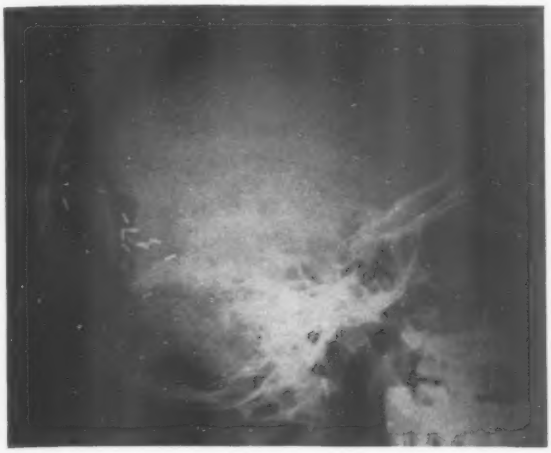

Fig. 8. Postoperative roentgenogram of the skull, lateral view.

Fig. 9. Postoperative roentgenogram of the skull, Towne's position.

of a borderline electroencephalographic study possibly suggestive of interseizure grand mal epilepsy, but indicating no definite focal abnormality.

CONCLUSIONS

1. A case of encephalotrigeminal angiomatosis (Sturge-Weber syndrome) has been presented. The pertinent findings were seizures, a "port-wine mark" on the face, left homonymous hemianopsia and the characteristic, double contoured, curvilinear calcifications following the cortical gyri.

2. Calcareous deposits were demonstrated in the outer layers of the cerebral cortex and not in the angiomatous malformation of the leptomeninges.

3. In selected cases extirpation of the pathologic area may be of benefit as is indicated by this presentation.

4. The roentgenographic findings are pathognomonic and reflect the pathologic changes.

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ROENTGENOLOGIC ASPECTS OF HEAD TRAUMA*†‡

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THE recent war, as well as an increasing number of civilian accidents, has resulted in ever-mounting concern with the early and late sequelae of head injury. The post-traumatic syndrome consisting of headache, memory lapses, inability to concentrate, vague somatic complaints, etc., sometimes accompanied by various manifestations of epilepsy has posed a problem in differential diagnosis which calls upon the utmost in our diagnostic armamentarium. Many of the complaints in this post-traumatic group are accompanied by intracranial changes which are demonstrable by diagnostic means at our disposal, among which roentgenology plays a leading role. Consideration is here given to the indications for roentgenography and to the diagnosis and interpretation of roentgenographic findings in fracture, subdural hematoma, porencephaly, pneumocephalus, arachnoiditis, brain atrophy and epilepsy.

There are only two situations which ordinarily require emergency roentgen studies of the skull following trauma: (a) If the patient's course suggests the presence of a tear of dural or meningeal vessels, roentgenography is indicated to ascertain the fracture site and the most probable site of rupture to facilitate proper operative procedure. (b) If physical examination and symptomatology suggest the presence of a depressed fracture, early roentgenography is again indicated so that corrective operative procedures may be employed.[2]

Experience has shown that many clinicians pay disproportionate attention to determining whether or not a fracture exists in injuries to the head. Actually, the presence of a fracture line is much less significant than the determination of whether hemorrhage, or concussion or contusion or laceration of the brain exists. Frequently, a patient with head injury is taken immediately to the roentgen department even though he is in shock—a condition which requires primary consideration. The additional manipulation to the traumatized head that is inevitable in roentgen examination may cause further damage or aggravation of symptoms.

Unfortunately, many institutions, particularly those of city, state, or federal government, require that roentgenograms be taken as soon as possible after the patient is brought into the hospital. In institutions of this type, the authorities should be educated to the fact that the examination had best be deferred for a week or ten days unless definite indications exist for immediate roentgen study. If, however, examination has to be performed, the radiologist should make sure that the personnel is indoctrinated to avoid excessive manipulation and postural strain.

FRACTURES

The roentgenologist is frequently called upon to express an opinion as to the age of a fracture and the extent of injuries. There is no workable rule which correlates the size, position and type of a fracture with the acute manifestation of head injury or with the sequelae. Many head injuries resulting in fracture have no deleterious effects. On the other hand, head trauma which fails to cause fracture may well result in serious injury to intracranial structures. There is no known method of predicting which form the late manifesta-

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tions of head trauma will take. The nature or type of the trauma has no predictable correlation with the type of organic encephalopathy which results.

The problem of determining the age of a fracture is of medicolegal interest. Reports have emphasized the fact that skull fractures notoriously do not follow the recognized scheme of fracture line obliteration observed in other bones.[4] For example, in children skull fracture lines take up to eight months or more to close, whereas in adults, fracture lines may persist up to three years or more. What is generally not appreciated, however, is the fact that not only do fractures of the skull take a long time to close, but that in addition there is no uniformity in the way they are obliterated. Looking at any single set of films on a patient who has sustained a skull fracture, the presence of haziness and rounding of the margins of the fracture line, as well as the presence of a shallow, gray line rather than a deep, black line, all may suggest an old fracture. The converse is definitely not true in all cases. The presence of sharp-edged, dark fracture lines is no guarantee of recent origin. In order to demonstrate the various types of healing reactions commonly encountered in skull injuries, the following case histories are submitted:

CASE 1. W. E. C. This fifty year old psychotic male patient was struck by another patient behind the right ear on September 25, 1947. He was unconscious for a period of ten minutes. A roentgenogram on that day revealed multiple linear fractures in the squamous portion of the right temporal bone and in the posterior portion of the right parietal bone (Fig. 1*A*). Re-examination on August 15, 1948, eleven months following the trauma shows complete loss of the identifying features of the fracture lines (Fig. 1*B*). The margins are well rounded, the lines hazy and the ends are rounded instead of angular. The lines have the roentgenographic appearance of the arterial channels and are only distinguishable from these channels by their atypical course and bifurcation. This is particularly well demonstrated by the fracture line in the posterior parietal region. Here there is dichotomous division of the lines such as is found in arterial bifurcation. However, the fork points downward toward the base instead of upward as is the case for arteries. The frac-

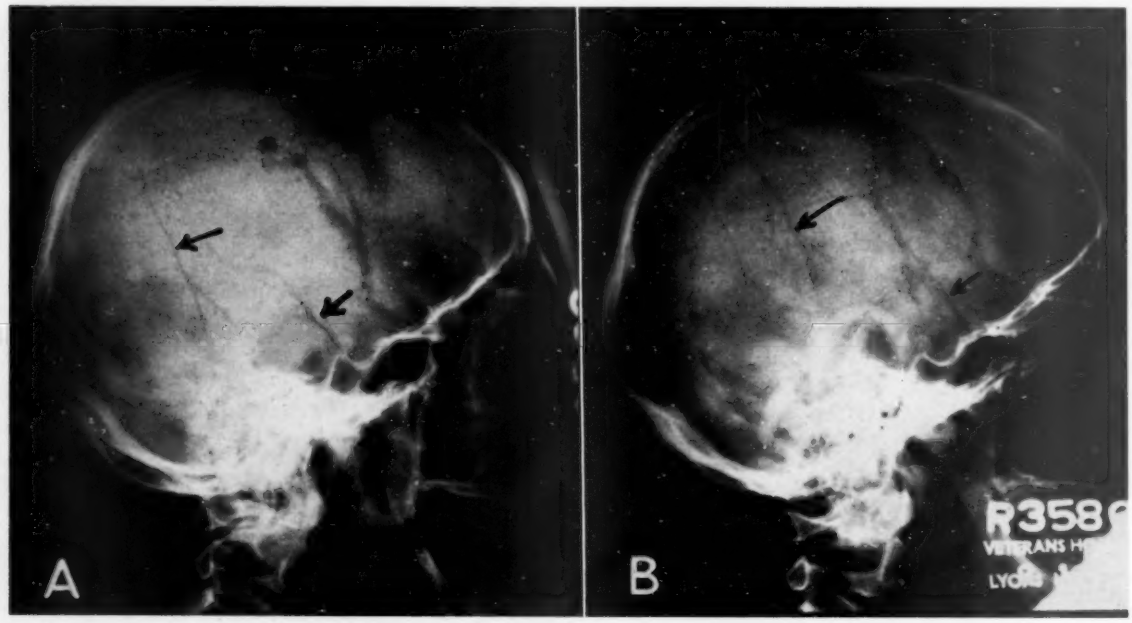

FIG. 1. Case 1. (*A*) Multiple linear fractures of the squamous portion of the right temporal bone and the right parietal bone. (*B*) Obliteration of fracture lines eleven months following trauma.

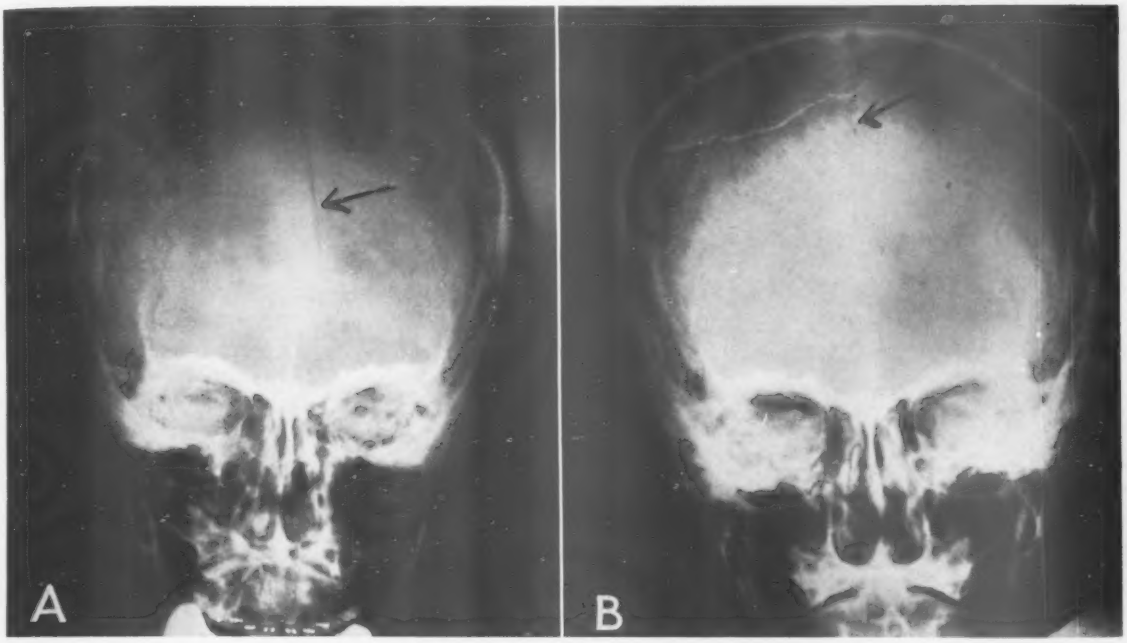

Fig. 2. Case II. (*A*) Linear fracture of the frontal bone. (*B*) Linear fracture of the frontal bone showing partial obliteration twelve months after trauma.

ture line in the temporal bone is practically indistinguishable from a branch of the middle meningeal artery, and only comparison with the original films reveals the true nature of this line.

Case II. F. McG. This is a seventy year old male with a diagnosis of schizophrenia, paranoid type. On July 29, 1947, he fell from the steps of his home and was unconscious for a period of approximately ten minutes. He was admitted to a hospital and examination of the skull revealed the presence of a fracture. The patient was transferred to this hospital and on October 23, 1947, examination of the skull revealed a linear fracture extending from the region of the bregma into the central portion of

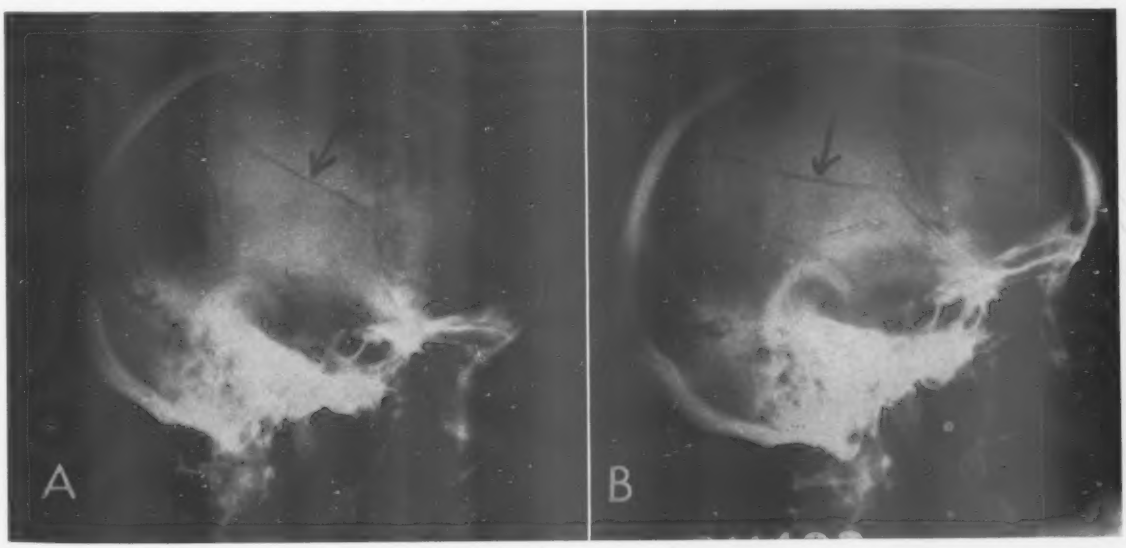

Fig. 3. Case III. (*A*) Linear fracture of the right parietal bone extending into the squamous portion of the right temporal bone. (*B*) Practically unchanged fracture twenty-one months following trauma.

the frontal bone (Fig. 2*A*). Re-examination on August 18, 1948, twelve months after the trauma, shows a fracture line as previously reported; there is some rounding of the margins and haziness of the fracture line, indicating partial obliteration (Fig. 2*B*). However, the appearance of this line in no way is indicative of the age of the fracture.

CASE III. J. J. B. is a fifty-two year old male with a staff diagnosis of general paresis. The patient is subject to grand mal epileptic seizures. On March 12, 1947, the patient suffered a ten minute seizure. At the onset of the seizure the patient fell from a standing position and struck the right side of his face and head on the floor causing marked swelling and moderate discoloration in the right infra-orbital area. Roentgenograms revealed a long linear fracture extending obliquely through the right parietal bone and the squamous portion of the right temporal bone (Fig. 3*A*). There was no depression of the fragments. Re-examination of the skull on December 20, 1948, twenty-one months following the original trauma, shows the fracture line as previously reported, in the squamous portion of the right temporal bone and the parietal bone (Fig. 3*B*). It is interesting to note that the outlines of the fracture are sharp and the ends are angular. There are no changes to suggest that any alteration or obliteration has occurred along the fracture line.

These cases demonstrate that it is not only impossible to give the relative age of a fracture from its roentgen appearance, but, in addition, fracture lines may persist for long periods of time without any change occurring indicative of healing.

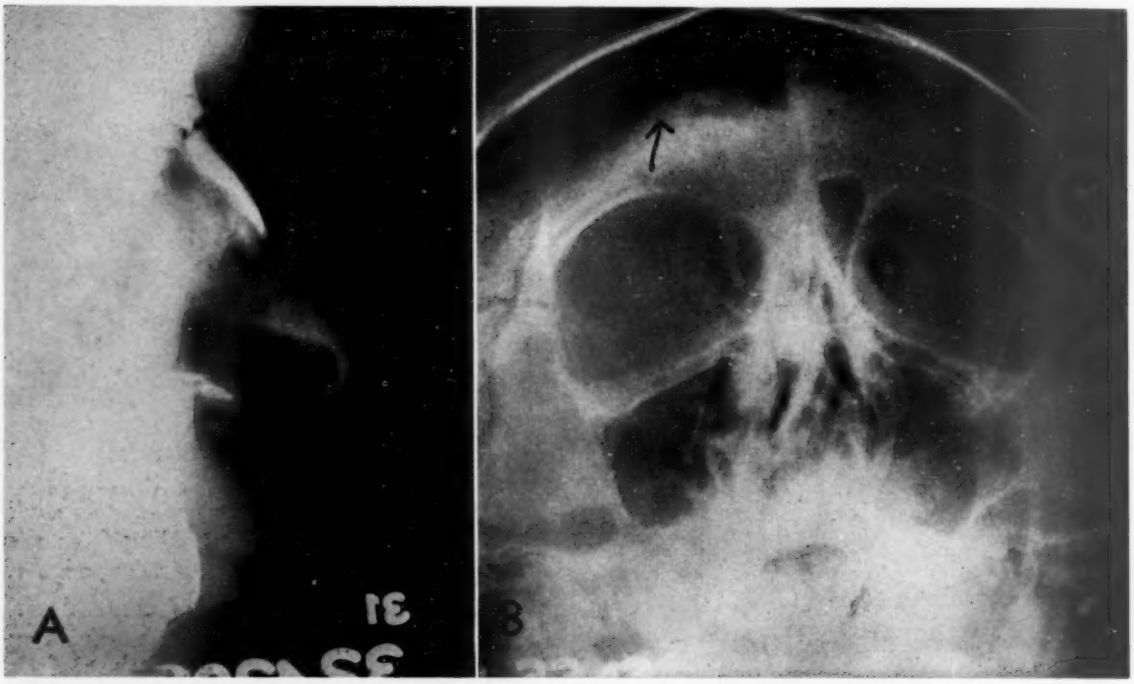

FIG. 4. Case IV. (*A*) Comminuted fracture of the nasal bone. (*B*) Pneumocephaly following fracture of the nose.

PNEUMOCEPHALY

Pneumocephaly is a relatively rare condition, whereby a fracture results in communication with the outside air through the skin or nose or through the nasal sinuses or the mastoids. The air may collect in the subdural space. Occasionally it appears in the subarachnoid space, from which a varying amount may pass into the ventricular system proper. The air is usually seen as a subdural or subarachnoid collection over the convexity in the frontoparietal region. The demonstration of intra-

cranial air is of no appreciable significance per se. However, it is definite evidence of communication with the exterior with its concomitant danger of infection. Pneumocephalus, therefore, is an indication for proper procedures to combat infection.

Case iv. P. H. This patient was in an automobile accident and was thrown face forward against the dashboard. Roentgenograms were taken of the nose and facial bones, but the patient insisted upon leaving the hospital and continuing on a homeward trip to another state before the films had been examined by a radiologist. A study of the films on the following day revealed the presence of a comminuted fracture of the nasal bone (Fig. 4*A*). Of greater interest, however, was the demonstration of air in the anterior portion of the cranial cavity (Fig. 4*B*). A diagnosis of traumatic pneumocephalus was made and the patient's physician notified. Subsequent recovery was uneventful and reexamination of the head one month later failed to reveal any evidence of air.

SUBDURAL HEMATOMA

Following trauma, there may be hemorrhage in the epidural, subdural or subarachnoid spaces or within the brain proper. Roentgen studies are of particular value in subdural bleeding.[5] Although subdural hematoma may occur shortly after trauma and be classified with the acute complications, it more commonly presents itself as a late complication. This condition is relatively uncommon. Following trauma there is a latent period of weeks or months followed by progressive headaches, drowsiness, and confusion.

Subdural hematoma is commonly caused by a tear of a meningeal vein with the formation of a blood clot between the under surface of the dura and the leptomeninges. It is most often seen over the dorsolateral aspect of the hemispheres and is bilateral in almost 50 per cent of the cases. Membranes form over the inner and outer surfaces of the organizing hematoma and encapsulate it. The underlying brain is compressed and undergoes atrophy. Roentgenologically, the lesion may be demonstrated by a shift of a physiologic calcification (usually the pineal) or by air study demonstration of a space-occupying lesion in the characteristic position with a characteristic history. However, there is nothing specific in the appearance of the ventricular displacement or deformity and occasionally subdural hematoma may be diagnosed on a basis of a pertinent history of trauma, and surgical exploration may reveal the presence of a tumor. Infrequently, air studies may reveal a characteristic distribution of air, first described by Dyke, following the injection of air intracranially. Some air may find its way between the membrane separating the inferior margin of the hematoma and the leptomeninges. The air will take a characteristic convex, elongated shape outlining a part or all of the inferior margin of the hematoma. Dyke called this sign the "finger sign" and considered it characteristic of subdural hematoma.[1]

Case v. C.R.P. This patient is a male, aged twenty-two, who sustained a blow in the head under circumstances which could not be elucidated, during the summer of 1947. Early in Oc-

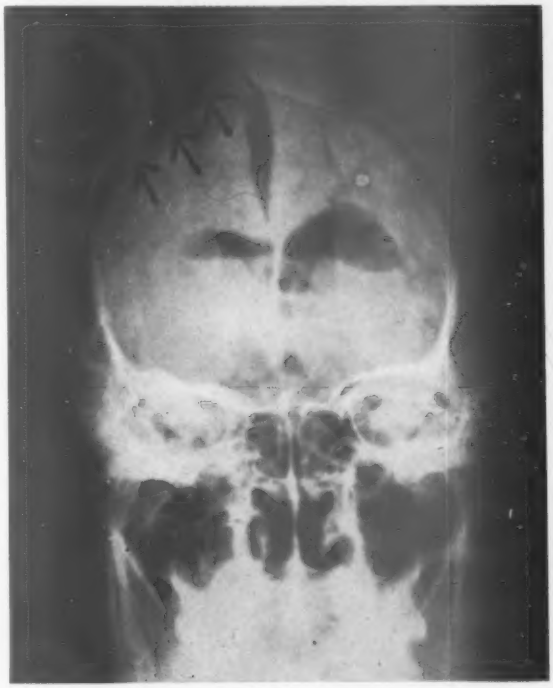

Fig. 5. Case v. Dyke's "finger sign," approximately six months following head trauma.

tober, 1947, his left hand started to jerk, then the left arm. He sat down and then lost consciousness for a few moments. When he recovered consciousness his left arm was stinging and felt weak. There was some confusion, but no headache, no incontinence or tongue biting. In about a half an hour he felt well. About one week later he had a similar attack, partially witnessed by his family. He bit his tongue in this seizure. A week later he felt dizzy for a few moments, then the left arm started to jerk and he lost consciousness. This attack was observed from beginning to end and was apparently a generalized convulsion with a jacksonian onset. He has had slight bitemporal headaches about once a month for the past few years. These are very mild and not accompanied by nausea or vomiting. His eyes have ached for the last two years.

Pneumoencephalographic studies on December 15, 1947 (Fig. 5) revealed flattening of the right lateral ventricle with a finger-like projection of air in the right parietal region surrounding a subdural soft tissue mass. Distribution of the air has the appearance of Dyke's "finger sign" for subdural hematoma.

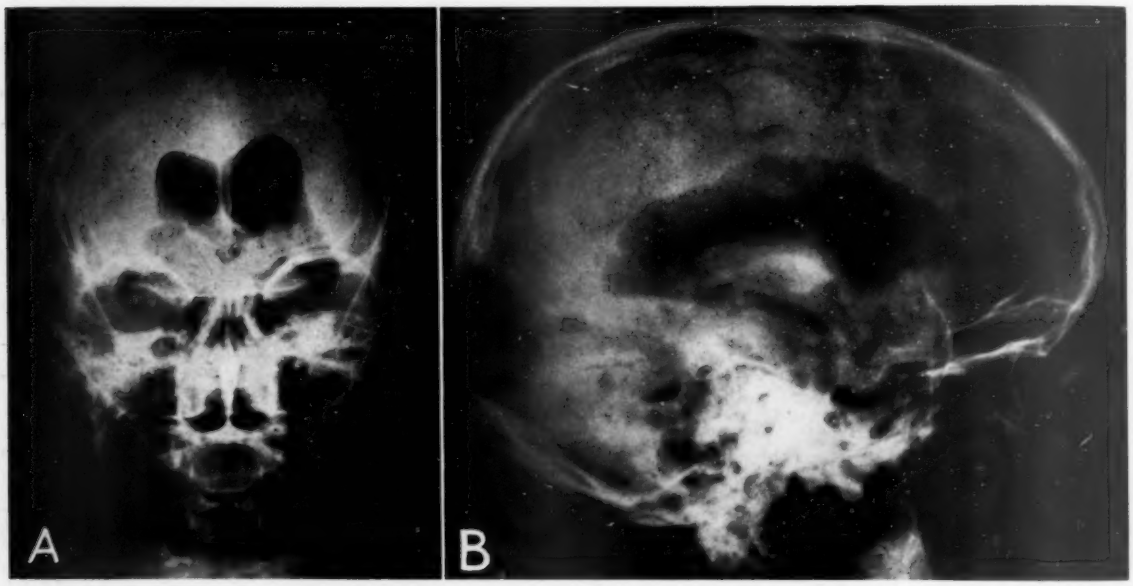

FIG. 6. Case VI. (*A*) and (*B*) Dilatation of the lateral ventricles and absence of the cortical markings in traumatic arachnoiditis.

ARACHNOIDITIS

Obliteration of the subarachnoid channels may result from trauma with marked thickening of the leptomeninges and interference with the normal exchange of fluid over the convexity and sometimes at the base of the skull. When adhesions interfere with the exchange of fluids between the cisterns and ventricular system a varying degree of internal hydrocephalus may result. Roentgenographically, these findings are manifested in the air study by absence of the cortical markings over all or a greater part of the convexity of the skull accompanied by varying degrees of hydrocephalus.

CASE VI. E.E.A. This patient is a forty year old veteran who was struck in the left temporal region of the head by an unknown assailant in the summer of 1944. He was unconscious for a period of approximately fifteen minutes and was treated by the insertion of three sutures to the scalp wound. In September, 1945, the patient experienced a severe shooting cephalic pain in the left frontal and parietal region which awakened him from his slumber. Patient has very meagre recollection of subsequent events which led to his hospitalization and including the early part of hospital confinement. He was admitted to a military hospital a few days later and lapsed into an apathetic, confused, disoriented state which persisted for approximately two weeks. The military records

also indicate that ocular fundoscopic examination revealed blurring of optic discs, motor incoordination and motor aphasic disturbance. Spinal fluid examination disclosed xanthochromic fluid with a manometric pressure of 120 mm. of water to 80 white blood cells of lymphocytic nature and a total protein of 21 mg. per 100 cc. He suffered from mild fever from October 1–3, 1945. It was stated that he laughed in a silly manner and that it was difficult to understand him. On October 7, the febrile manifestation subsided but the ocular fundoscopic and aphasic signs continued. Following his discharge from the military service, patient experienced episodes of occipital and temporal headaches at weekly intervals. These were of short duration and were relieved by aspirin. Following a rest of three months, he worked sporadically for his father, but avoided strenuous labor. According to the family history, the patient experienced two convulsive seizures at night, the first occurring in May, 1946, with a second occurring in September of that year. On both occasions attention was attracted to him because he had fallen out of bed, displayed marked restlessness, followed by loss of bowel control. There were no apparent convulsive movements and recovery was complete with total amnesia for the episode.

Pneumoencephalographic studies on April 18, 1947 (Fig. 6*A* and *B*) revealed no evidence of air over the convexity immediately following the procedure, nor twenty-four hours after the instillation of the air. There is definite asymmetrical dilatation of both lateral ventricles. These findings indicate the presence of bilateral, asymmetrical hydrocephalus with absence of subarachnoid markings indicating the presence of arachnoiditis.

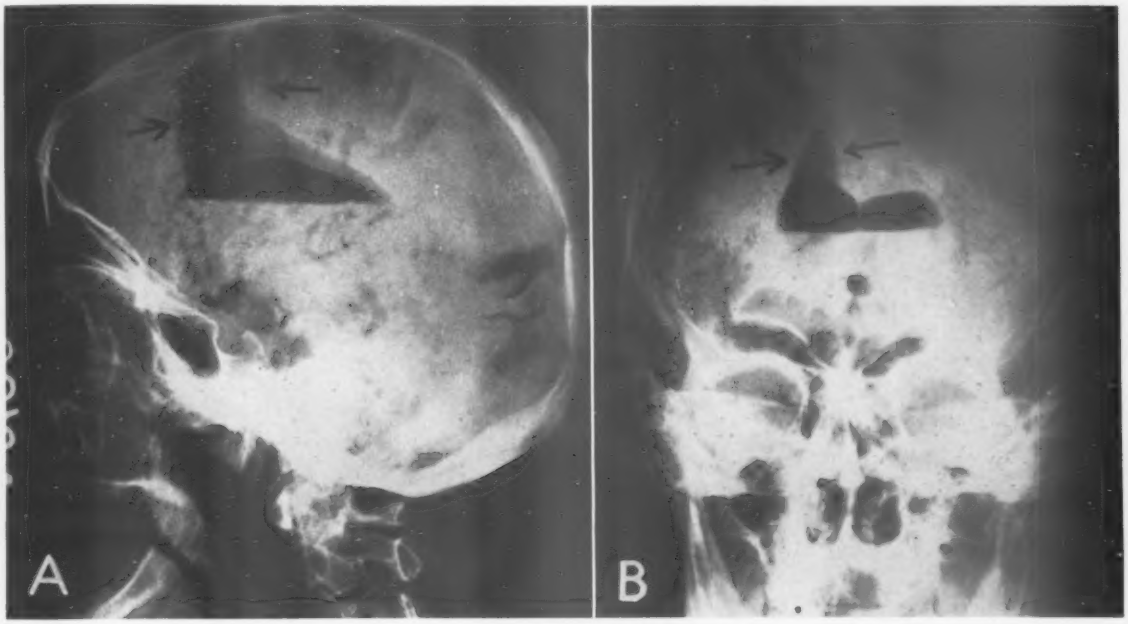

Fig. 7. Case vii. (*A*) and (*B*) Asymmetrical dilatation of both lateral ventricles with a porencephalic cyst communicating with the anterior horn of the right lateral ventricle.

PORENCEPHALIC CYST

Another complication of trauma probably due to hemorrhage into the brain or interference with the blood supply of a segment of it is porencephalic cyst. A cavity forms at the site of the degenerated portion of the cerebrum, although rarely the cerebellum may be involved. The cavity may or may not communicate with the ventricular system. When it communicates, it is demonstrable by air studies. It is particularly important to note that the cavity may not be demonstrated immediately after the air is injected into the ventricular system, but may first show up in the film taken twenty-four hours after the procedure. It is therefore our policy to

take twenty-four hour films on all patients who undergo encephalography.

CASE VII. F.J.P., male, aged thirty-nine. In 1944 he sustained a traumatic subarachnoid hemorrhage while in service and was hospitalized for six to eight months. Since that time he has shown marked hesitancy in speech, and complained of chronic, almost daily headaches, and marked loss of memory. These symptoms have continued unchanged until the present time. At an indefinite time in the Spring of 1948 he suffered a generalized convulsion. Recovery was complete. However, there was no change in any of his previous symptomatology. In June, 1948, he had another generalized seizure which he reports himself, but which was not verified by other observers. In July he had a generalized seizure which is reported to have started by pulling of the mouth upward on the left side. Since that time there have been no further seizures, but the headaches and other symptoms have continued.

Pneumoencephalographic studies revealed (Fig. 7*A* and *B*) asymmetrical dilatation of both lateral ventricles, particularly on the right. There is a large air-containing space within the right half of the cerebrum communicating with the anterior horn of the right lateral ventricle, indicating the presence of a porencephalic cyst.

ATROPHY

Localized or generalized brain atrophy not accompanied by other changes such as porencephalic cyst or arachnoiditis may occur following brain injury. This is manifested by varying degrees of dilatation of the cortical markings, enlargement of the ventricular system, as well as widening of the basal cisterns.

FIG. 8. Case VIII. (*A*) and (*B*) Post-traumatic atrophy three years following trauma.

CASE VIII. W.M. This patient is a twenty-seven year old veteran who received a head injury in the Philippines in October, 1945. The previous films were not available but roentgen studies at the Veterans Administration Hospital, Lyons, New Jersey, on August 24, 1948, revealed a faint line of diminished density in the squamous portion of the right temporal bone which has the appearance of an old fracture. Patient claims he was unconscious for several weeks following injury and has no recollection of the accident. Since then he has been having headaches for varying periods of time, chiefly confined to the left temporoparietal region. On July 9, 1948, he suddenly

began to have severe headaches associated with nausea, dizziness, and vomiting. Since being hospitalized the dizziness has disappeared and he has only a heavy feeling in his head. Pneumoencephalography was performed on September 26, 1948 (Fig. 8*A* and *B*) and revealed symmetrical dilatation of both lateral ventricles with slight dilatation of the subarachnoid sulci over the convexity and fairly marked dilatation of the basal cisterns. No evidence of a space-occupying lesion was demonstrated. These findings indicated the presence of a traumatic brain atrophy, when correlated with the clinical history.

EPILEPSY

Roentgen studies in patients who develop epilepsy following head trauma reveal findings which may be divided into three groups:

1. No roentgenographic evidence of abnormality of the ventricular system or the cortical markings.
2. Demonstration of an organic change such as arachnoiditis, hemilateral or bilateral cortical atrophy, porencephalic cyst, leptomeningeal cyst, etc.
3. Visualization of a localized area of non-filling in the subarachnoid space indicative of the presence of a meningeocerebral scar.

The demonstration of these scars is best obtained by combining pneumoencephalography with subdural instillation of air through a trephine opening.[3] It is our feeling, however, that these epileptogenic foci may be picked up more easily by electroencephalography.

LEPTOMENINGEAL CYST

Following head trauma, and particularly where a severe fracture of the vault has been sustained, a leptomeningeal cyst may result. These cysts consist of loculated, enlarged subarachnoid spaces which have a tendency to increase slowly in size and cause pressure atrophy of the adjacent portion of the bone (Fig. 9*A* and *B*). According to Dyke, the roentgenographic criteria for the diagnosis of leptomeningeal cysts are:

1. Evidence of an old fracture with widening of the fracture line and thinning of its margins.
2. Scalloping of the inner table in the vicinity of a fracture due to the presence of a cyst.
3. Localized increased vascularity of bone.

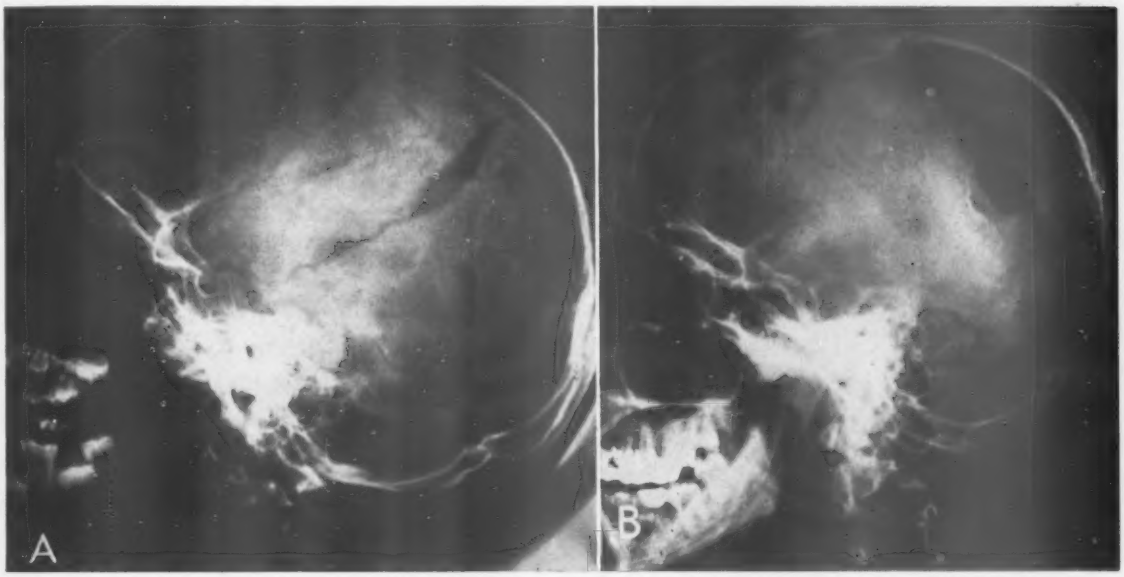

Fig. 9. (*A*) and (*B*) Leptomeningeal cysts following antecedent fractures of the skull.

SUMMARY

The roentgenological aspects of head trauma have been discussed and the appearance of the more common sequelae demonstrated.

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Vol. 64, No. 3

APLASIA OF THE LUNG

WITH ANGIOCARDIOGRAPHIC DEMONSTRATION OF ANOMALOUS PULMONARY CIRCULATION

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HISTORICAL

APLASIA of the lung is a rare occurrence. There have been approximately 55 proved cases reported in the literature. Most of the reported cases are from autopsy records. The diagnosis of pulmonary aplasia during life has been accomplished 16 times. This relative rarity of diagnosis during life is brought about by the fact that these patients usually have no symptoms referable to the respiratory tract. It is also true that the clinical and roentgenological picture may be confused with that of atelectasis. However, with the advent of mass surveys of the chest, it is thought that an increasing number of these anomalous conditions will be brought to light during the lifetime of the patient. A tabular review of those cases of aplasia of the lung diagnosed during life is given in Table 1. Also given in this table are the associated congenital anomalies found with this condition.

This communication is considered original in no sense, since Ferguson and Neuhauser,[5] in 1944, adequately discussed the diagnosis of aplasia of the lung by conventional means. Vallee and Graham[16] have stated that exploratory thoracotomy is the only means of proving the existence of aplasia of the lung during the lifetime of the patient. It is thought that we are presenting an original method for corroboration of this diagnosis by the angiocardiographic demonstration of the anomalous pulmonary circulation. We would like to present 2 cases of this condition, one with angiocardiographic studies and one with unusual skeletal deformities.

ETIOLOGY AND INCIDENCE

The primary etiology of aplasia of the lung is thought to be endogenous and due to faulty germ plasm. It is not thought to be due to pressure by the thymus as has been suggested by Eppinger (quoted by Schneider[13]). The developmental anomaly is postulated as originating as follows: Arey[1] states that a groove-like evagination arises from the ventral esophagus in the 3 mm. embryo. This buds into two at its lower extremity. Muscle and cartilaginous tissues differentiate from the surrounding connective tissue. Failure of either of these buds to appear results in aplasia of one of the lungs.

Schneider[13] has divided agenesis into three types based on the failure of development of pulmonary tissue. His classification is as follows:

Type 1. Complete aplasia of the bronchus.

Type 2. Small bronchus with no pulmonary tissue.

Type 3. Small bronchus and a small amount of pulmonary tissue.

The third type is the least common. The second type is the one most commonly seen. It is of interest that in the cases reported the left lung is involved three times as frequently as the right and that males predominate in a ratio of three to two. Vallee and Graham[16] state that of the cases reported in the literature at the time of their report in 1944, 25 cases were under the age of twelve, 11 cases were found who were older than nineteen, and 3 cases reported lived to be fifty-eight, sixty-five,

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TABLE I

TABULAR REVIEW OF REPORTED CASES OF APLASIA OF THE LUNG DIAGNOSED DURING LIFE

Author	Date Reported	Age	Sex	Side Involved	Proved by	Symptomatology	Other Congenital Abnormalities
Gilkey[9]	1928	6 mo.	M	Right	Autopsy	Dyspnea and cough	Absent
Van Loon and Diamond[15]	1941	3½ yr.	F	Right	Bronchoscopy; bronchography	Cough and noisy breathing	None
Gartside[8]	1943	7 yr.	M	Left	Bronchography; bronchoscopy	No respiratory symptoms	Cervical ribs, hemivertebra D-10, congenital heart disease, fusion of ribs
Vallee and Graham[16]	1944	41 yr.	F	Left	Exploratory thoracotomy	Pain in chest and cough	None
Ferguson and Neuhauser[5]	1944	2 yr., 9 mo.	F	Left	Bronchography; bronchoscopy	Cough and poor weight gain	Absence left hand
		4 mo.	F	Right	Bronchography; bronchoscopy	Dyspnea and exertional cyanosis	Renal hypoplasia
		6 mo.	M	Left	Bronchography; bronchoscopy	No respiratory symptoms	Congenital deformity of external ear
		4 mo.	F	Right	Bronchography	Dyspnea	Hemivertebra, spina bifida, and fusion of ribs
		3 wk.	M	Left	Bronchography; bronchoscopy	Asymmetry of chest cage in examination	Hair lip and cleft palate
Deweese and Howard[2]	1944	6 mo.	M	Right	Bronchography; bronchoscopy	Cough and cyanosis of 8 days' duration	None
Field[6]	1946	1 yr.	F	Left	Bronchography; bronchoscopy	No respiratory symptoms	Microcephaly, talipes equinovarus
		10 yr.	F	Left	Bronchography; bronchoscopy	Repeated upper respiratory infection	None
		5½ yr.	F	Right	Bronchography, bronchoscopy, and autopsy	Cough and cyanosis	Congenital heart disease
Smart[14]	1946	30 yr.	F	Right	Bronchoscopy	Asthma, frequent upper respiratory infection	Congenital anomaly of ribs
Nesbitt, Paul and Middleton[12]	1947	40 yr.	F	Left	Bronchography; bronchoscopy	Dyspnea and tightness in chest	None

and seventy-two years of age. From the above listed facts it is seen that aplasia of the lung is a truly rare condition.

SYMPTOMATOLOGY AND PHYSICAL FINDINGS

Symptomatology is variable—rarely are symptoms distressing. Those patients who live beyond infancy are usually asymptomatic. Dyspnea and cyanosis are noted in the younger group when they have symptoms. Physical examination usually reveals dullness to percussion over the affected side which is caused by the displacement of the heart to the affected side. There is variability in the literature as to asymmetry of the thorax. Most of the later authors, however, state that no significant asymmetry is found. Physical examination may reveal the presence of other congenital abnormalities which may be associated with this disturbance. (The congenital conditions which are associated with this are listed in Table I.)

REPORT OF CASES

Case 1. This patient was a ten year old Negro female who had been well all of her life. She was examined for routine health program and the apex impulse was found in the right anterior axillary line in the fifth interspace. There was dullness to percussion in the right chest with hyper-resonance in the left. There was marked asymmetry of the thorax, the right being much smaller than the left. Examination of the heart revealed no murmurs and the heart sounds were of normal quality. Laboratory findings were within normal limits. The electrocardiogram was normal in spite of the unusual position of the heart in the right chest. Bronchoscopic examination revealed the trachea to be displaced to the right side. There was complete absence of the right bronchus. The left bronchus appeared longer than usual but showed no other abnormalities. Bronchograms revealed no trace of a right main bronchus. The remainder of the bronchial tree showed no abnormalities.

Roentgen Study (Fig. 1). There is marked displacement of the mediastinum to the right. The trachea is visualized and appears longer than usual. The left lung appears moderately emphysematous.

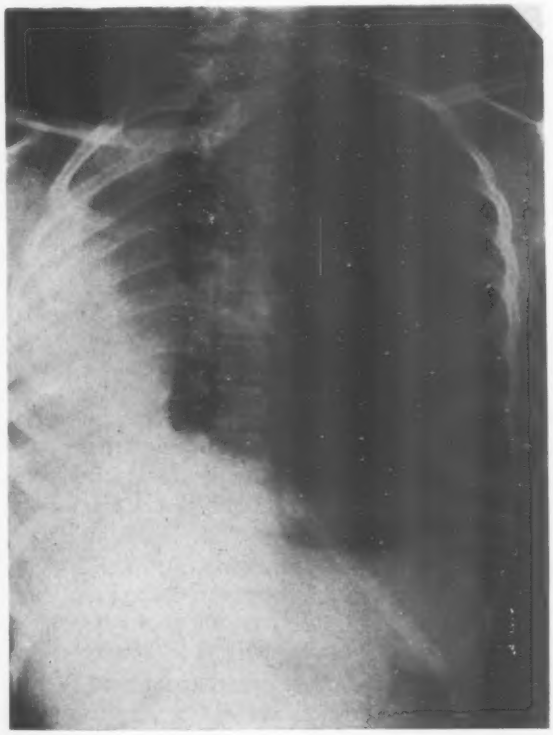

Fig. 1. Case 1. Posteroanterior roentgenogram of the chest shows marked constriction of the right hemithorax with marked shift of the mediastinum. There are moderate emphysematous changes throughout the left lung field. No associated skeletal changes are noted.

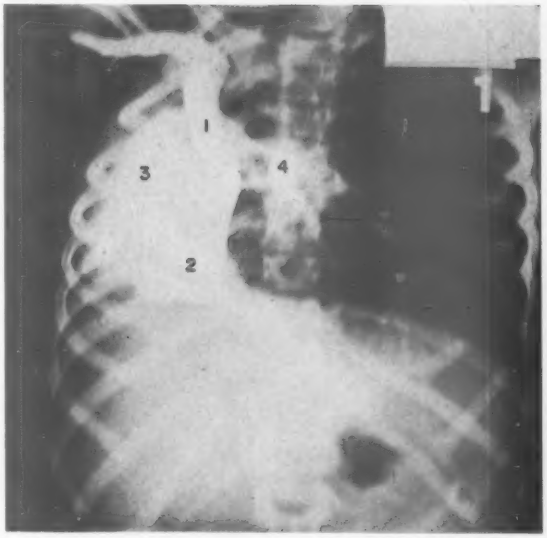

Fig. 2. Case 1. Angiocardiogram shows filling of the right heart: (*1*) superior vena cava; (*2*) right ventricle; (*3*) conus of right ventricle; (*4*) pulmonary artery.

Angiocardiography. With rapid antecubital vein injection of 70 per cent diodrast, using a rapid cassette changer, films were made at intervals of one second. With this technique, the heart and great vessels were well visualized and showed the following changes (Fig. 2, 3 and 4); the dye can be seen to enter the superior vena cava (*1*), right ventricle (*2*), conus of the right ventricle (*3*), and the single pulmonary artery (*4*) in rapid succession. The dye then fills the pulmonary tree and is seen to flow back to the heart by way of a single pulmonary vein (*5*), thence to the left auricle (*6*) and from here the dye flows out through the systemic circulation: left ventricle (*7*), aortic arch (*8*), and dorsal aorta (*9*). The great vessels are seen leaving the aortic arch at *A*, *B* and *C*. It can be seen from this examination that there is marked displacement of the heart to the right with marked rotation of this structure. It is also obvious from study of these films that there is a single pulmonary artery present.

Case 11. First Vanderbilt University Hospital admission of a male, aged fourteen months, who was admitted to the hospital because of failure to gain weight and frequent upper respiratory infections. Physical exam-

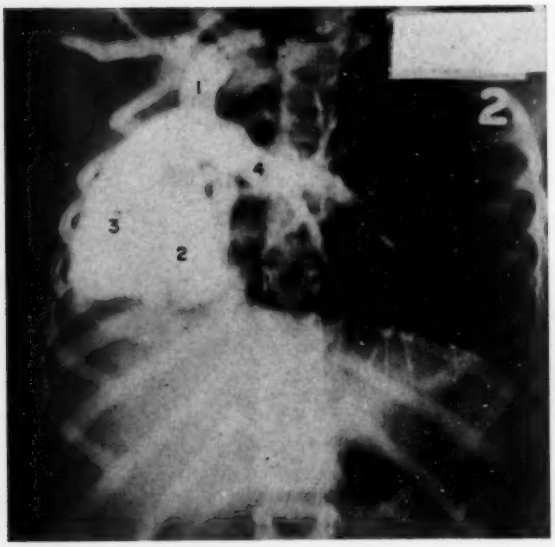

FIG. 3. Case I. Angiocardiogram shows the same as Figure 2 plus adequate filling of the single pulmonary artery (*4*).

ination revealed poor development. The heart showed a harsh systolic murmur over the precordium with a shift of the heart to the left.

Roentgen study revealed marked shift of the heart and mediastinal contents to the left. There was asymmetry of the chest cage with narrowing of the interspaces on the left. The trachea was shifted to the left. From this same film it is evident that there is a hemivertebra deformity of the eighth dorsal vertebra with fusion defects of the right eighth and ninth ribs posteriorly and of the eleventh and twelfth ribs on the left anteriorly.

Because of the association of hypoplasia of the lung with hemivertebra previously described by Gartside[8] and later by Ferguson and Neuhauser,[5] the patient was bronchoscoped. The trachea and right bronchus were normal. Considerable difficulty was found in locating the left main bronchus. The lumen was about one-half to one-third its normal size and the suction tip could be inserted a distance of about 2 cm. No further detail could be made out.

FIG. 4. Case I. Angiocardiogram shows filling of the left heart and systemic circulation. They are listed as follows: (*6*) left auricle; (*7*) left ventricle; (*8*) aortic arch; (*9*) dorsal aorta, and *A*, *B* and *C*, vessels arising from the aortic arch.

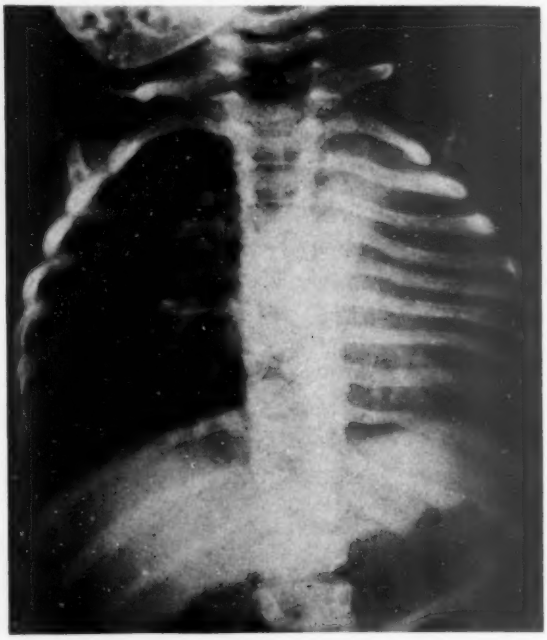

FIG. 5. Case II. Posteroanterior roentgenogram of the chest shows marked shift of the mediastinum to the left with narrowing of the interspaces in the left chest. Hemivertebrae in the lower dorsal bodies are also noted. Fusion defects are seen in the eighth and ninth ribs posteriorly and in the eleventh and twelfth ribs anteriorly.

Final Clinical Impression. (1) Aplasia of the lung; (2) congenital heart disease, type undetermined; (3) hemivertebra of the eighth dorsal vertebra.

SUMMARY AND CONCLUSIONS

Aplasia of the lung is usually asymptomatic. It occurs in males more frequently

than females in a ratio of three to two. It is seen three times as often on the left side as on the right. Cases diagnosed are usually the result of an accidental finding during physical examination or roentgenographic study in cases of extrapulmonary disease.

Two cases of aplasia of the lung diagnosed during life have been presented. This brings to eighteen cases the total number which have been diagnosed during life. In Case I the findings were further corroborated by angiocardiographic demonstration of a single pulmonary artery. This is believed to be the first time that such a study has been undertaken, since there is no previous report in the literature. Case II is in no way unusual except that it is a proved case of aplasia of the lung, diagnosed during life. It does show a congenital defect of the spine with hemivertebra of the dorsal spine, which occurrence had previously been reported by Gartside[8] in England in 1943 and by Ferguson and Neuhauser[5] in 1944 in this country.

It is thought that with further use of the mass survey method in chest roentgenography many heretofore undiagnosed cases of aplasia of the lung will be recorded.

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ANEURYSM OF THE PULMONARY ARTERY*

REPORT OF A CASE

By WILLIAM J. CLIFFORD, M.D.,† WILLIAM F. MACGILLIVRAY, M.D.,‡
and RAYMOND H. GOODALE, M.D.§

ANEURYSM of the trunk or main branches of the pulmonary artery is rare. Among 37,757 consecutive autopsies reviewed by three groups of investigators[11,13,14] not a single case was encountered. Eight cases have been recorded in 109,571 necropsies.[5,6,7,8,11,12,14,15] At the Worcester City Hospital one case was found in postmortem examinations. A review of the literature to August, 1948, reveals only 148 cases[7] which have been confirmed by necropsy, to which we are adding another.

The criteria for correct classification of lesions of the pulmonary artery have been stressed by Boyd and McGavack[2] and by Deterling and Clagett[7] in their excellent reviews. There must be at necropsy a permanent, circumscribed dilatation of the pulmonary artery or its two main branches, with demonstrable organic degeneration of its wall. This definition clearly eliminates a considerable number of reported cases.

As Groedel[10] points out the exact number of authenticated cases thus far published cannot be accurately estimated, for it is necessary to distinguish between true aneurysm, diffuse dilatation of the arteria pulmonalis communis (common pulmonary trunk) and multiple dilatations of the arteriae pulmonales (smaller pulmonary arteries).

The authors feel, then, that this case merits reporting because it is rare, a true aneurysm of the pulmonary artery, which developed under observation and which was proved by autopsy. It is unique because the patient had been studied at various hospitals for apparently unrelated complaints. The development of the aneurysm may be accurately traced by an extensive roentgenologic record complied during these admissions.

CASE REPORT

The patient was first hospitalized as a child of ten (1919) at a Worcester hospital because of acute abdominal pain following otitis media of three weeks' duration. Laparotomy revealed adhesions in the region of the terminal ileum. These were lysed. No roentgen examination of the chest or red blood count was taken at this time.

At the age of twenty-six (1935) she was admitted to the Worcester City Hospital a few hours after passing a hydatidiform mole. Physical examination was negative. Her red blood cell count was 7,350,000, with a hemoglobin of 85 per cent. A chest roentgenogram was not taken.

Seven months later (1936) she was admitted to Memorial Hospital in Worcester because of menorrhagia and back pain. These symptoms dated to her discharge in 1935 from Worcester City Hospital. On her second hospital day she underwent a dilatation and curettage with lysis of pelvic adhesions, and a left oophorectomy because of a corpus luteum cyst. Neither a red blood cell count nor chest film was taken at this time.

One year later (1937) she returned because of a similar complaint. A partial resection of the right ovary was performed. Pathological diagnosis was multiple simple cysts and lutein cysts of the right ovary. Physical examination was negative.

Seven months later she reported to a Boston Clinic where a diagnosis of endometriosis was postulated on the basis of her history and physical examination. Surgery was advised but the patient refused.

On June 28, 1938, a chest roentgenogram was taken for the first time (Fig. 1). No abnormality was noted.

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On October 4, 1938, a chest film (Fig. 2) was taken because of right-sided pleurisy of indefinite duration. This revealed a moderately dense exudative shadow involving a small area at the periphery of the right lung in the vicinity of the upper interlobar fissure. A tentative diagnosis of minimal tuberculosis was made and she was admitted to the Worcester County Sanatorium on October 29, 1938. Physical examination on admission revealed no abnormal heart or lung findings. Sputum examinations for acid fast organisms were consistently negative. Her condition remained unchanged on a regimen of bed rest, and she continued to complain of right-sided chest pain. A chest film taken (Fig. 3) on December 16, 1938, six weeks after admission, revealed that the lesion in the right upper lung field had disappeared while there was widespread infiltration at both lung bases.

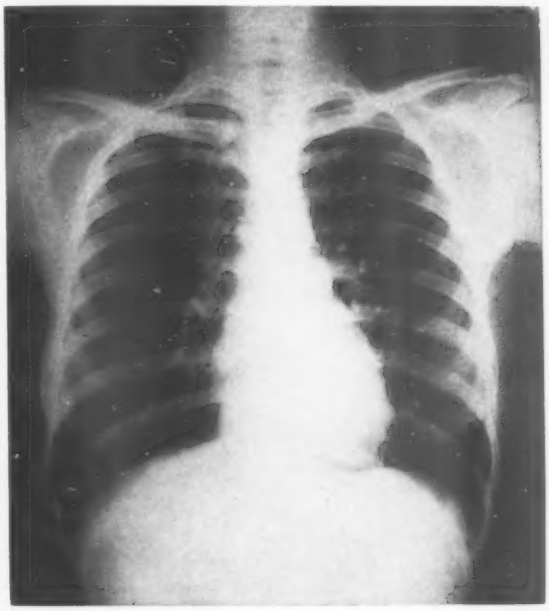

Fig. 1. June 28, 1938. First recorded chest roentgenogram of patient taken approximately four months before the onset of pulmonary symptoms.

On January 2, 1939, a sputum positive for tubercle bacilli was obtained, and pneumothorax was immediately instituted. Following the pneumothorax refills, the patient became so dyspneic that these were discontinued. Chest roentgenograms during the period of pneumothorax therapy revealed a pleural thickening at the right base (Fig. 4). Following discontinuance of this therapy, the patient became more comfortable but continued to complain of bilateral pleuritic pain.

Fig. 2. Roentgenogram of October 4, 1938, showing the moderately dense exudative shadow involving the small area at the periphery of the right lung near the upper interlobar fissure.

Fig. 3. Roentgenogram of December 16, 1938. The lesion in the right upper lung field has disappeared. Widespread infiltration is seen in both lung bases.

FIG. 4. Roentgenogram of January 5, 1939, taken during pneumothorax therapy showing pleural thickening at the right base.

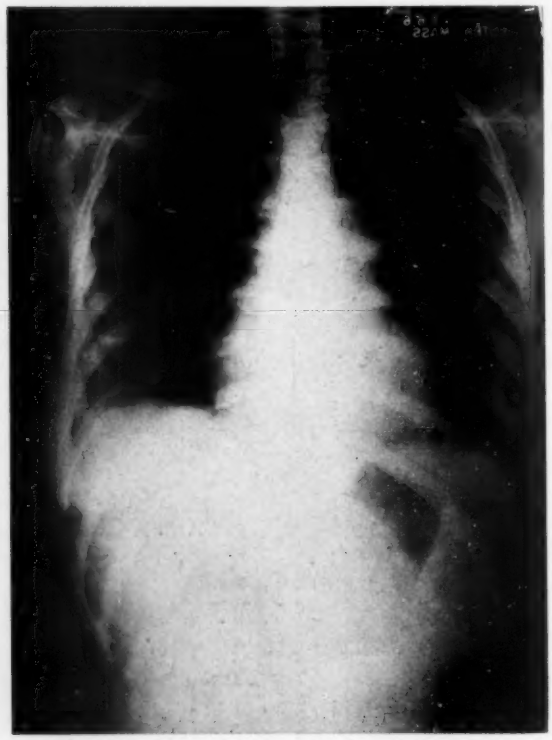

FIG. 5. Roentgenogram of March 8, 1939. The right lung has completely expanded. Areas of infiltration suggestive of pulmonary emboli.

On March 8, 1939, she suddenly developed a severe attack of dyspnea and cyanosis. A portable chest roentgenogram taken on this day (Fig. 5) showed complete re-expansion of the right lung with evidence of infiltration consistent with generalized pulmonary emboli. An electrocardiogram at this time revealed right axis deviation and sinus tachycardia.

The marked cyanosis and dyspnea continued, interrupted only by more severe attacks of dyspnea and cyanosis which were provoked upon movement of the patient. She developed considerable edema in both legs and in the left arm. There were also several small ulcerated lesions scattered over the lower abdomen and skin of the legs. Her temperature varied between normal and 100° F. Blood cultures were repeatedly negative. She had several bouts of small hemoptyses.

FIG. 6. Roentgenogram of May, 1939. There is dense infiltration throughout the lower half of both lung fields. The heart has greatly enlarged.

Early in May, 1939, there was a sudden marked improvement. Her edema subsided, the cyanosis gradually disappeared and the heart rate subsided to normal. A roentgenogram taken in the latter part of May (Fig. 6) showed dense infiltration throughout the lower half of both lung fields, and the heart was enlarged to twice its normal size.

She was discharged from the sanatorium in July, 1939, symptom free after nine months of hospitalization. A roentgenogram at the time of discharge (Fig. 7) revealed that the densities in the lung field had greatly diminished, but the cardiac enlargement persisted.

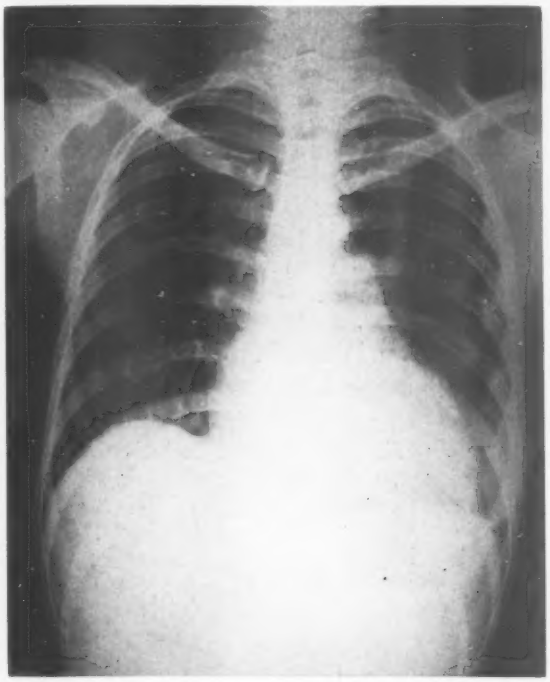

Fig. 7. Roentgenogram of July, 1939. The densities present in May, 1939, have disappeared. Cardiac enlargement persists.

One month later she was admitted to Worcester City Hospital in severe respiratory distress with a dry hacking cough and tightness in her mid-chest of one week's duration. Right-sided pleurisy had been persistent since her discharge from the Worcester County Sanatorium and in addition she complained of severe occipital headache. Physical examination of the heart was negative. A chest roentgenogram taken on admission revealed that the right apex was obscured by a homogeneous density. The right hilus was elevated. Nine days later roentgenoscopy revealed that the density at the right apex had diminished. There was an area of increased density laterally overlying the second rib anteriorly. The right lower lung field was mottled and showed areas of decreased density with sharp borders consistent with large bronchi. The heart was enlarged to the left and to the right. A chest roentgenogram taken at the same time (Fig. 8) revealed that

Fig. 8. Roentgenogram of August, 1939, showing enlargement of the pulmonary conus.

the density in the right upper lung field had disappeared and the pulmonary conus was enlarged. The patient improved so markedly on supportive therapy that she was discharged on her twelfth hospital day. The laboratory findings on this admission were essentially negative. The red blood cell count varied between 4,700,000 and 5,250,000, with a hemoglobin constant at 80 per cent.

She was admitted to the Worcester Memorial Hospital on May 8, 1942, with cellulitis of the right thigh. Dyspnea and cyanosis had been marked and intermittent since 1940 and had been accompanied by a dry, hacking cough. On April 4, 1941, chest film revealed persistent prominence of the pulmonary conus (Fig. 9). Four months prior to admission there had been a severe exacerbation of these complaints and she had been given diuretic agents and digitalis with considerable relief.

The cellulitis was responding well to chemotherapy when she suddenly developed abdominal cramps and diarrhea associated with aggravation of cough, dyspnea and cyanosis. For the next four days, the abdominal symptoms persisted, her temperature rose steadily to 104° F. and the cellulitis disappeared. During this period a chest film (Fig. 10) revealed in-

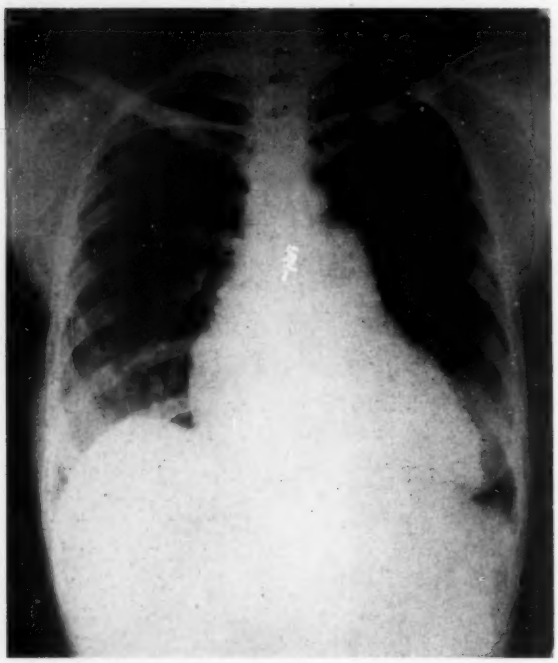

FIG. 9. Roentgenogram of April 4, 1941, showing persistent enlargement of the pulmonary conus.

definite areas of consolidation throughout both lung fields measuring up to 1 cm. in diameter. She had several bouts of small hemoptyses during this time.

She was next admitted to Worcester City Hospital on September 20, 1943, following a massive hemoptysis. Since her discharge from Memorial Hospital she had been well enough to perform routine duties. On occasion she was afflicted with chest pain of a vague nature. She continued to suffer from exertional dyspnea and orthopnea which was peculiar because it became less severe during the night. Physical examination revealed an acutely ill, dyspneic patient. The entire precordium heaved with each heart beat and there was a systolic retraction of the first and second left interspaces. Heart sounds were booming with P_2 markedly accentuated. No murmurs were heard. On September 25, 1943 (Fig. 11) chest films were not remarkable except for enlargement of the pulmonary conus. An electrocardiogram taken at this time showed right axis deviation with sharp inversion of T_2 and T_3 and slight inversion of T_4. Laboratory findings were essentially negative. Red blood cell count varied between 4,650,000 and 5,595,000. After ten days' supportive treatment the patient had improved so dramatically that she was discharged.

The last chest film was taken on August 2, 1946 (Fig. 12) in conjunction with diagnostic studies not requiring hospitalization.

Her final admission was on August 7, 1948, following a headache of explosive onset of forty-eight hours' duration. She was moribund on admission and passed into coma on her third hospital day with signs of a brain abscess. She was markedly cyanotic and her neck veins were distended. There was a loud blowing systolic murmur heard at the apex and with equal intensity over the xiphoid process. This was transmitted to the left base. The right lung was clear. Because of the patient's moribund condition a chest film was not taken. Laboratory findings were not remarkable. Red blood cell count was 5,860,000.

Throughout all her hospitalizations the blood pressure was maintained at normal levels. The Hinton and Kahn tests were repeatedly negative.

Postmortem Examination. The body is that of a well developed, well nourished, white female with no evidence of cachexia. The extremities are moderately cyanotic. There is no acral clubbing. The skin of both legs is indurated and discolored brown to within a distance of 5 cm. of the knee joint where it is sharply demarcated from the skin above.

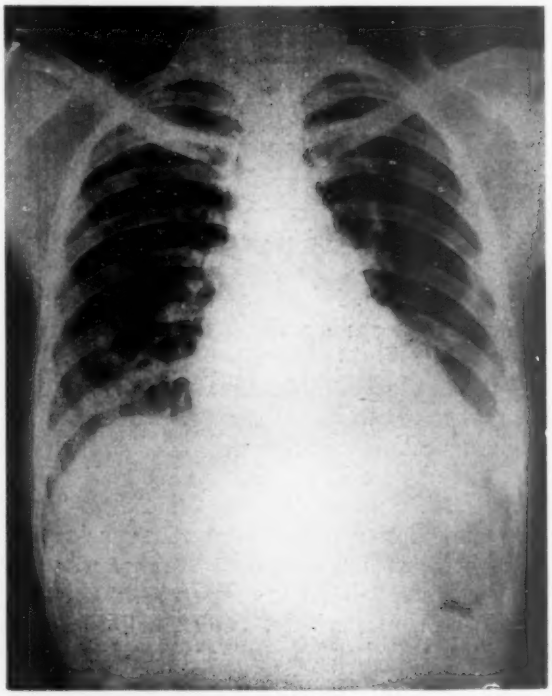

FIG. 10. Roentgenogram of April 8, 1941. There are indefinite areas of consolidation throughout both lung fields measuring up to 1 cm. in diameter.

Brain: Weight 1,500 gm. The veins of the cerebral cortex are dilated and prominent. A large abscess cavity involving the right temporal and parietal lobes is found. It is filled with dark green foul-smelling pus which on culture yielded *Staphylococcus aureus*. The remainder of the brain is not remarkable.

Heart and Great Vessels: Upon opening the chest, the lungs are seen to be remarkably pale. The heart is enlarged both to the left and the right. The pericardial cavity contains 100 cc. of straw colored fluid. The left ventricle is enlarged downward and to the left with the apex in the anterior axillary line. The right ventricle is 4–5 cm. to the right of the midsternal line. The heart, lungs and mediastinal contents are removed en bloc.

The pulmonary artery is seen to be greatly enlarged and this in conjunction with the prominent and hypertrophied right ventricle gives the appearance of a congenitally deformed heart. The aorta is normal in its origin, size and course. The pulmonary artery contains a saccular dilatation which arises from the pulmonary trunk and involves throughout its extent the left branch of the pulmonary artery. It impinges on and is adherent to the left border of the right auricle. The dilatation of the artery begins 1 cm. from the pulmonary valve and replaces the entire anterior and left wall of the pulmonary trunk and the left pulmonary artery. The saccular dilatation is supported by the hilus of the left lung inferior and anterior to the left main stem bronchus. The saccular dilatation measures 5 cm. in diameter. Its base is composed of a bed of granular amorphous black material which is extremely friable. The center of this area is at the site of attachment of the aneurysmal wall to the right auricle. The wall of the aneurysm at the site of division into the pulmonary branches to the left lung is seen to be atheromatous and the walls of the branching vessels pout into the aneurysmal chamber. The ligamentum arteriosum is unremarkable as are the aorta and coronary vessels. The right ventricular and auricular chambers are markedly dilated and hypertrophied. The wall of the right ventricle measures 1.1 cm. in thickness. The left ventricular wall measures 1 cm. in thickness. The valves measure: tricuspid value, 10 cm.; pulmonary value, 9 cm.; mitral value, 7.5 cm.; aortic value, 6 cm.

Lungs: Both lungs are bound down with adhesions between the visceral and parietal pleura. They are pale, crepitant but firm except at the bases where they are edematous. Cut section reveals marked fibrosis throughout both lung fields. The left main stem bronchus passes superiorly to the aneurysmal dilatation of the pulmonary artery. There is no deformity of the bronchus at this point. Dissection of the bronchi reveals marked peribronchial fibrosis. The pulmonary vessels are essentially unremarkable except as described.

Fig. 12. Roentgenogram of August 2, 1946. Last roentgenogram of the chest before the patient's death.

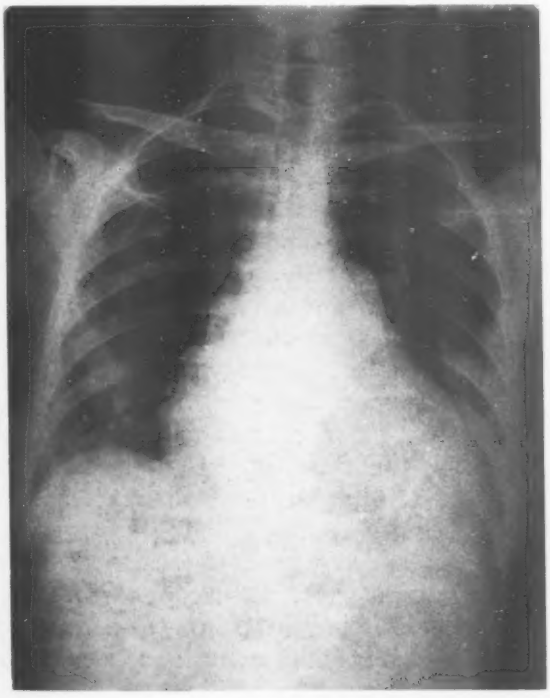

Fig. 11. Roentgenogram of September 25, 1943. Persistent enlargement of the pulmonary conus.

The remainder of the postmortem examination is not remarkable.

Microscopic Findings. All viscera showed evidence of acute and chronic passive congestion. The myocardium was not remarkable revealing only minimal myocardial fibrosis. There was marked peribronchial fibrosis of all branches of the bronchial tree. The walls were markedly thickened to two to three times the usual size. In addition, there was evidence of passive congestion by the appearance of red blood cells. edema fluid and hemosiderin loaded macrophages in the pulmonary alveoli. The pulmonary capillaries were engorged. The sections taken through the aneurysmal wall revealed marked necrosis of the intima which extended through approximately one-half the media. The intima was completely absent and replaced by homogeneous tissue containing blood spaces suggestive of degeneration granulation tissue. The media contained deposits of hemosiderin. There was marked perivascular lymphocytic reaction around the vasa vasorum of the adventitia. This reaction was also present in the media but was less well marked. Gram-Weigert stain of the aneurysmal wall failed to reveal the presence of bacteria.

DISCUSSION

This case is typical in many respects to the majority of other reported cases of pulmonary aneurysm, both in symptoms and signs, the course and the uncertainty of the etiology. It is unique because of the extensive roentgen evidence of its development. It was not diagnosed antemortem, probably because the clinicians were not aware of the existence of the condition. However, aneurysms of the pulmonary artery may be more common than the literature on the subject would indicate. It is remarkable that in the ten year period that the patient experienced symptoms reflecting chest pathology the only cardiac findings were enlargement of the heart to the right and the left, sinus tachycardia and right axis deviation. There was a significant lack of cardiac murmurs. During the period of illness she had been examined by many competent cardiologists. The paucity of clinical signs and the rather cursory examination of the pulmonary artery at autopsy may be partly responsible for the rarity of the condition. It is not a common practice at autopsy to measure the size of the pulmonary artery and unless the pathology is readily apparent, as in the case here reported, diffuse, small but definite dilatations of the pulmonary artery or its major branches may be overlooked.

This patient undoubtedly had pulmonary hypertension. The etiology of this, however, cannot be accurately ascertained. It is significant that the first appearance of symptoms indicative of pulmonary pathology occurred approximately four years prior to the recognition of the enlarged pulmonary conus. That the initial complaint was out of proportion to the severity of the underlying pulmonary disease is evidenced by the effect of pneumothorax upon the patient. Although the roentgenogram of the chest showed a minimal lesion, upon institution of this therapy she became so dyspneic that treatment was abandoned. With her initial complaints she probably had a vital capaicty which was significantly reduced.

The subsequent history is one of exacerbations and remissions. Both the clinical picture and the chest roentgenograms are consistent with the diagnosis of multiple pulmonary emboli as the causative factor in these episodes. This is also supported by the appearance of the aneurysm at autopsy. Since the first of these attacks occurred within five months of the initial symptoms, the wall of the pulmonary artery would seem to be involved at that time. The exact nature of the anginal pathological process, however, cannot be stated. The patient died at the age of thirty-seven which is the mean age of death from this condition. The duration of symptoms was ten years.

Age and Sex. Aneurysms of the pulmonary artery occur with equal frequency in males and females[2,7] in comparison to aortic aneurysm which occurs five times as frequently in males. The mean age in Boyd and McGavack's review[2] was 37.7 years. Thirty-four per cent of pulmonary artery aneu-

rysms occur before thirty years of age[1] in contrast to 16 per cent of aortic aneurysms before this age. There are 4 aneurysms of the pulmonary artery for every 1,000 aortic aneurysms.

Location. The main trunk is involved primarily in 80 to 89 per cent of cases.[2,5,7] In 8 per cent the right branch was involved, in 3 per cent the left, according to Deterling and Clagett.[7]

Etiology. The etiology of pulmonary arterial aneurysm is regarded by Brenner as traumatic, mycotic, congenital or syphilitic, with a majority falling in the two latter groups. Others feel atheroma is a significant etiological finding.[7] Breslin[4] believes that pulmonary hypertension is of extreme importance in the causation of this lesion. East[9] states that essential or primary pulmonary hypertension represents a definite clinical and pathological entity, not to be confused with secondary forms found in conjunction with mitral stenosis, Ayerza's disease and extensive pulmonary disease. This is a progressive hypertension which is followed by dilatation and hypertrophy of the right ventricle, and, as a consequence of this hypertrophy, a further increase of pressure is slowly built up and a vicious cycle established. Local disease may provide a place of lessened resistance for the beginning of the aneurysm.

Congenital defects may accelerate the condition. Indeed, most authors consider such anomalies important as an etiological factor in about 40 per cent of cases.[2,7] Patent ductus arteriosus is far more common than all other congenital defects, occurring in more than 20 per cent of all cases.

Syphilis is of much less significance than Warthin[16] believed.

On the basis of the cases we have studied, it is frequently difficult to be certain of the exact etiology, for a combination of the above listed conditions is commonly present.

Symptoms and Signs. Palpitation is said to be the earliest symptom, but it is a relatively uncommon one. Dyspnea is the most striking complaint and is present in over two-thirds of all cases. Cyanosis, edema, chest pain and cough occur in that order of frequency and hemoptysis is common enough to cause patients to spend long periods in sanatoria.

There is frequently a prominence of the thoracic cage at the region of the second and third left costal cartilages. A murmur, systolic and/or diastolic, and a thrill are best elicited in the second left interspace. Dullness in this area accompanies the enlargement of the aneurysm. In no instance was hoarseness a complaint in contrast with its frequency in aortic aneurysm.

Roentgen studies reveal a lengthening and lateral prominence of the pulmonary arterial shadow in the anteroposterior view and an encroachment on the posterior mediastinum below the aortic arch on a right anterior oblique view. Pezzi's sign or a bilateral hilar dance may be demonstrable. Some form of roentgen study was positive in 57 per cent in Deterling and Clagett's[7] review.

Seventy-five per cent of cases show a right axis deviation by electrocardiography.

SUMMARY

1. A case of pulmonary aneurysm diagnosed at necropsy is reported.

2. It is unusually well supplemented by an extensive clinical history which dates accurately the duration of symptoms and signs.

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Vol. 64, No. 3

REPORT OF A CASE OF LONG STANDING RENAL INSUFFICIENCY WITH EXTENSIVE METASTATIC CALCIFICATIONS (RENAL OSTEITIS FIBROSA CYSTICA)

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THIS is the report of a patient with renal osteitis fibrosa cystica with ectopic calcification. In many respects this patient followed the usual clinical pattern of this rare condition. However, the probable duration of renal insufficiency for many years and the presence of metastatic calcifications for at least eighteen years prior to death are unusual features. The survival of the patient is longer than that of any of the cases cited in the literature.

Since the original description of Virchow in 1885 we have found 29 cases in the literature of metastatic calcifications secondary to chronic renal disease. Mulligan[11] reviewed 23 cases. He included in this review the patient reported by Albright, Drake and Sulkowitch[1]; the case is strikingly similar to the one we are reporting. In 5 of these there was the complicating factor of vitamin D administration. Six instances of renal osteitis were reported by Sussman and Poppel[14] and 3 of these had ectopic calcifications. One example each was reported by Kaufman and Dow,[9] Soffer and Cohn[13] and Curtis and Feller.[4] Only 1 patient was over fifty, and almost 65 per cent of the cases reported died before the age of forty.

Chronic renal disease may result in excessive enlargement of the parathyroid glands. When sufficient renal parenchyma has been destroyed the ability of the kidneys to excrete phosphates becomes impaired. Drake, Albright and Castleman[5] consistently produced hyperplasia of the parathyroid glands after the injection of phosphates in rabbits. Highman and Hamilton[7] found hyperplasia and hyperactivity of the parathyroids after inducing renal insufficiency in dogs. The changes in the glands became apparent after about the month. One may conclude, therefore, that in man as in experimental animals an elevation of blood phosphate and a diminution of blood calcium is followed by compensatory hyperplasia of the parathyroids.

The osseous changes resulting from chronic renal insufficiency are due to acidosis, to interference with calcium absorption in the gastrointestinal tract and, in part, to excessive secretion of parathormone. Ginzler and Jaffe[6] believe that the parathyroids play no part in the bone changes when these are not marked and only microscopic. In these instances the bone changes are the result of the inability of the kidneys to form bases. There is a loss of fixed base which then comes from calcium and magnesium stored in the bones. Ginzler and Jaffe claim that in such early cases the parathyroids are not the cause of the bone changes in spite of associated parathyroid hyperplasia. In the presence of pronounced osseous changes, these authors believe that the parathyroid hyperfunction is a definite contributory factor.

McLean and Hinrichs[10] have accounted for the deposition of calcium in the soft tissues by comparing these changes with those produced in animals by the injection of phosphates. A non-diffusible colloidal phosphate of calcium results which is disposed of by deposition in the soft tissues. The tissues most prone to be the sites of these calcifications are those that are relatively alkaline: that is, in organs where acids are excreted, namely: the lungs, the left heart, the systemic arterial tree,

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stomach and kidneys. Mulligan in his review described calcium deposits in the lungs in 12 patients; in the kidneys in 10; in the heart in 11; in the systemic arteries in 15; and in the stomach in 3. Among the miscellaneous sites, calcific deposits in the periarticular structures were present in 4 cases. It should be noted that in 21 instances of metastatic calcifications secondary to parathyroid tumor reviewed by Mulligan[11] no periarticular calcifications were described. Barr[2] has stated that metastatic calcifications are almost unheard of without renal disease.

Ginzler and Jaffe have described the osseous changes which may result from prolonged renal insufficiency. When these changes are minimal they may be detected only by microscopic examination but when they are far advanced they are detected grossly. In the early stages there is osteoclastic resorption of the bone lamellae and fibrosis. In this stage there is little evidence of any new bone formation. In the more advanced stages the trabeculae become thickened and completely distorted by bone sclerosis. Here reparative processes are in advance of the resorptive ones.

Since the pathological features of the bones in primary and secondary hyperparathyroidism are identical, it is natural that roentgenographically these conditions are also indistinguishable. According to Jaffe[8] the earliest changes are rarefaction of the cortices, even without thinning, and obscuring of the spongiosa. Later there is subperiosteal cortical scalloping of some of the long bones. This author states that the early changes are not diagnostic and that a roentgenographic diagnosis can be made safely only when the bone lesions are advanced. In these instances there is cortical thinning and blurring of the trabecular outlines of the spongy bone ends. There are also cysts which expand the bones. In the advanced cases there is a peculiar granular mottling of the calvarium. In the patient reported by Albright, Drake and Sulkowitch[1] there was absence of the lamina dura about most of the tooth sockets.

Jaffe[8] discussed the renal condition in children and adults which may result in secondary hyperparathyroidism. In children the pathological changes in the kidneys are a result of some congenital defect, while in adults the kidney disease may be due to a glomerulonephritis or pyelonephritis. In both, metastatic calcifications may appear.

In secondary hyperparathyroidism there is usually enlargement of all of the parathyroid glands and these may reach an enormous size. In the report of Albright, Drake and Sulkowitch the total weight of all the parathyroid glands was 11 grams as compared with the normal total weight of 240 milligrams. The size according to Pappenheimer and Wilens[12] is in direct proportion to the duration of the renal insufficiency. Usually the enlargement of all the four glands is uniform. However, according to Castlemen and Mallory[3] this is not always true and in some instances just one gland is enlarged. Even in such a situation, according to these writers, hyperplasia is present in all of the glands. This is predominantly a chief cell hyperplasia as compared with the clear cell hyperplasia in primary hyperparathyroidism. In secondary hyperparathyroidism the size of the cells does not vary greatly from the size of the normal chief cell. In primary hyperplasia the cell size is considerably greater than normal.

The blood chemistry findings in secondary hyperparathyroidism are quite distinct from those in primary hyperparathyroidism. In primary hyperparathyroidism the serum calcium is elevated, the serum phosphorus is lowered. With bone changes the alkaline phosphatase is elevated. In secondary hyperparathyroidism due to renal disease there is an increased serum phosphorus, normal or low serum calcium, slight elevation in the serum alkaline phosphatase and a low CO_2 combining power.

CASE REPORT

W. F., male, aged fifty-five. This patient was first admitted to this hospital on April 1, 1946,

complaining of shortness of breath and edema of the ankles. His present illness dated back to an attack of influenza four months prior to admission. After this attack the patient noted increasing dyspnea followed by edema of the ankles, substernal distress and nocturia.

Past History. The patient volunteered the information that at the age of seven years he did not urinate for five days following an upper respiratory infection. The physician who treated him called it Bright's disease. At the age of fifteen the patient complained of aching in the knees, shoulders and elbows but there was never any redness or swelling of the joints. At the

Fig. 1. Roentgenogram of pelvis shows a large cyst with calcific material in right pubis, and clear cysts in the iliac bones; calcifications in and about the hip joints, in the symphysis pubis and calcifications adjacent to the ischia and pubes. A right ureteral calculus is also shown.

age of thirty-six his right kidney was removed because of stones. While in the hospital for this condition his knees were roentgenographed and he was asked by his physician whether he had sustained any injury. It was noted that the patient had received compensation since World War I for chronic arthritis. There was no history of the use of vitamin D.

Physical Examination. Physical examination revealed an acutely ill, middle aged male, who was dyspneic and orthopneic. Blood pressure 240/150, pulse 130. The heart was enlarged to palpation and percussion. The liver edge was palpable 3 finger-breadths below the costal margin. There was pitting edema of the legs and ankles.

Laboratory Examinations. Repeated urinalyses revealed traces of albumen in all specimens and many leukocytes. Specific gravity ranged from 1.005 to 1.016 Phenolsulfonphthalein excretion: 10 per cent the first hour, 5 per cent the second hour. Red blood cell count 3,500,000; hemoglobin 11 gm.; nonprotein nitrogen varied from 60 mg. per 100 cc. to 120 mg. per 100 cc.; serum calcium, 8 mg. per 100 cc., serum phosphorus, 2 mg. per 100 cc. (Our

Fig. 2. Roentgenogram of left shoulder shows a cyst in the head of the humerus. Other cysts and calcifications in and about shoulder joint are not shown on this illustration.

Fig. 3. Roentgenogram of the hands shows calcifications in and about the metatarsophalangeal and wrist joints. There is also shown cortical thinning of the bones and foamy spongiosa in the metacarpals and phalanges. The cysts in the carpal and wrist bones are not shown.

FIG. 4. Roentgenogram of the right knee shows articular and periarticular calcifications and calcifications in the quadriceps tendon. A cyst is seen in the patella and there is also seen cortical thinning of the long bones.

opinion is that the value for serum phosphorus was in error.)

Roentgen Examinations. Chest: There is marked enlargement of the left ventricle. Abdomen: The right renal shadow is missing and a large calculus in the ureteral stump is seen at the level of the right sacroiliac joint. Musculoskeletal: Extensive interarticular and periarticular deposits are seen in the shoulders, elbows, wrists, hands, hips, knees, ankles and feet. Calcifications are noted in the lumbar intervertebral discs and symphysis pubis. Calcifications are present in the muscle attachments to the ischia and inferior pubic rami; at the tendon insertions of the triceps, biceps and quadriceps femoris and in the plantar aponeuroses. There is generalized cortical thinning of the long bones and slight trabecular separation of the spongiosa. A marked granular osteoporosis of the calvarium is present. The choroid plexuses are calcified. A large cyst with calcified contents expands the body and the ascending ramus of the right pubis. Clear cysts are found in the iliac bones near the hip joints; the carpals, metacarpals, left femoral condyle, right patella and both humeri. There are suggestive calcifications in the left radial artery but other vessel calcifications are not seen.

FIG. 5. Roentgenogram of the ankles shows calcifications in the plantar aponeurosis and Achilles tendons.

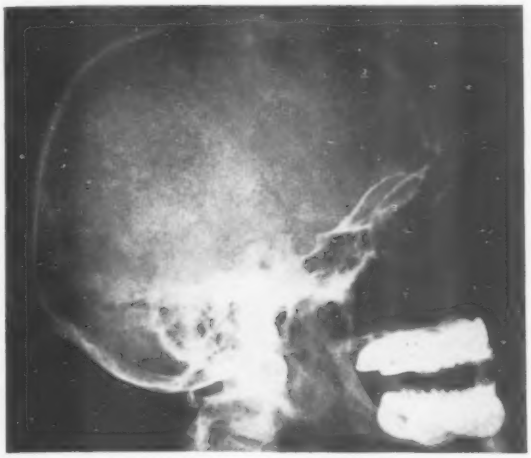

Fig. 6. Roentgenogram of the skull shows granular osteoporosis and calcifications in the choroid plexuses.

Review of Films Taken in August, 1938. We had the opportunity of reviewing films of the hands, wrists, and left shoulder taken in August, 1938. The changes present are almost identical with those taken during his last admission.

After treatment for heart failure the patient improved slightly but the signs of renal failure persisted. However, he insisted on going home and was discharged on May 17, 1946, before further studies could be accomplished.

Final Admission. On December 4, 1946, the patient re-entered the hospital complaining of dyspnea, diarrhea, and headaches. Blood pressure 210/130, pulse 94. Except for moist rates in both bases and 2 plus edema of the legs and ankles there were no new abnormal physical findings.

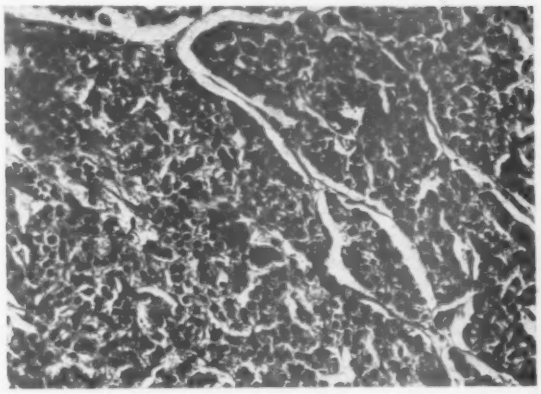

Fig. 8. Section of smaller parathyroid (×120) shows moderate hyperplasia of chief cell variety.

Laboratory Findings. Urine: traces of albumin were found in all specimens examined. Specific gravity ranged from 1.010 to 1.012. Blood: red blood cell count, 2,700,000; hemoglobin, 8.5 gm.; nonprotein nitrogen 100 mg. per 100 cc. (Dec. 11, 1946); serum calcium 10 mg. per 100 cc. (Dec. 13, 1946); total proteins 5.5 gm., serum albumin 3.7 gm., serum globulin 1.8 gm. Serum phosphorus 9.4 mg. per 100 cc. Serum alkaline phosphatase 3.9 Bodansky units (Dec. 13, 1946). Co_2 combining power 18 volumes per cent (Dec. 13, 1946).

Course in the Hospital. A few days after readmission to the hospital the patient began to complain of substernal pain on excretion relieved by nitroglycerine. On the evening of December 16 the patient developed nausea,

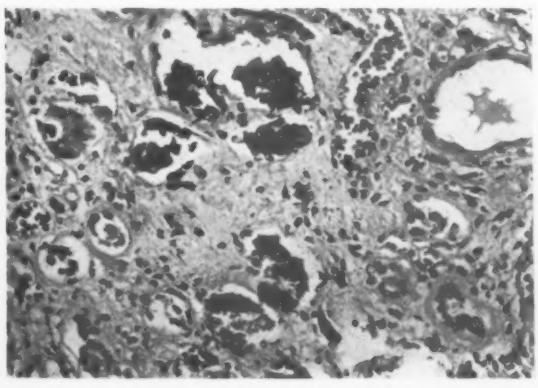

Fig. 7. Section of the kidney (×120) shows the obliterated glomeruli. Extensive calcification is noted in the tubules. There is marked increase in the interstitial tissue.

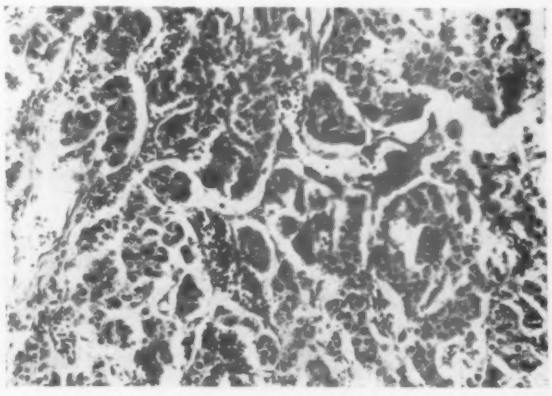

Fig. 9. Section of large parathyroid (×120). Chief cell hyperplasia with some atypical nuclei is noted. This gland appears much more vascular than the other glands.

vomiting and diarrhea, and recurrence of substernal distress. He subsequently became hyperpneic, rapidly became worse in spite of treatment and died on the tenth hospital day.

Postmortem Findings. Gross: Parathyroid glands: The two upper and one lower parathyroid glands were enlarged to twice their normal size and were of unususally firm consistency. Their color was grayish brown. There was one large flattened gland between the esophagus and the cervical spine. It measured 3 by 2 by 0.6 cm. Heart: The heart weighed 700 gm. and the enlargement was primarily due to hypertrophy of the left ventricle. There was calcification in the first portion of the descending branch of the left coronary artery and in one segment of the right coronary artery. No occlusions of the vessels were noted. Genitourinary tract: The right kidney was surgically absent. The left kidney weighed 80 gm. On cut section the parenchyma appeared remarkably pale and all architectural details were obscured. A calculus measuring 2.5 cm. in diameter was located in the right ureter just above the rim of the pelvis.

Postmortem Blood Chemistry: Serum calcium 14.2 mg. per 100 cc. Alkaline phosphatase 8.5 Bodansky units. Serum phosphorus 9.7 mg. per 100 cc. CO_2 combining power 8 volumes per cent.

Microscopic Findings. Kidneys: Sections of the kidney showed many of the glomeruli to be partially or completely fibrotic or hyalinized. There were extensive calcific deposits in the tubular epithelium, especially in the collecting tubules, but not limited to them. The interstitial tissues were markedly increased and in some places exhibited focal accumulations of lymphocytes. The small arterioles showed no essential changes but the larger arteries were thickened and showed intimal proliferations. There were no calcifications in any of the blood vessels. Parathyroids: Each of the slightly enlarged parathyroids showed a similar structure. There was hyperplasia which uniformly was of the chief cell variety. The average diameter of these cells was about 20 microns. In the large parathyroid the cellular cytoplasm was similar to that seen in the other glands and in some areas showed some variation in size. However, the hyperplasia in this gland was primarily of the chief cell type.

Diagnoses. (1) Fibrosis and atrophy of remaining kidney consistent with the end stage of chronic glomerulonephritis or chronic pyelonephritis. (2) Calcifications of renal tubules probably due to hyperparathyroidism. (3) The appearance of the smaller parathyroids is consistent with the diagnosis of secondary hyperparathyroidism. The large gland, while showing some atypical features in the varying size of the nuclei, resembles closely the other parathyroid glands in its histologic picture.

SUMMARY

The case of a man aged fifty-five, with a history of Bright's disease in childhood, who subsequently developed renal insufficiency and extensive metastatic calcifications, is presented. The unusual features of this case are the prolonged illness and the probable presence of metastatic calcifications eighteen years prior to death.

The essential features of secondary hyperparathyroidism due to renal disease have been reviewed.

We thank Dr. Fuller Albright who reviewed the case report and the roentgenograms and Dr. Benjamin Castleman who reviewed the microscopic sections.

ADDENDUM

Since the manuscript was submitted, one of us (R.T.L.) saw a private patient with features similar to the one reported above.

This woman, aged forty-one, complained of swelling of the lower extremities and shortness of breath. Acute nephritis was diagnosed five years ago; three years ago her blood pressure was found to be elevated. One year ago she was hospitalized for generalized edema. At approximately the same time she developed swellings at the ends of her fingers which were slightly painful. She was never on vitamin D medication.

Physical examination revealed generalized edema. Blood pressure 160/105. Numerous hard nodules were present in both hands, mainly near the terminal interphalangeal joint, in the elbows, the hips and the shoulders.

Roentgen examination of the chest showed suggestive left ventricular hypertrophy and a mass of calcification in the soft tissues of the left shoulder.

A roentgen skeletal survey revealed calcific masses in the left shoulder, dorsal aspects of the

forearms, soft tissues adjacent to the greater trochanters, soft tissues adjacent to the lateral femoral condyles, and in the soft tissues medial to the head of the left first metatarsal. In the hands extensive periarticular and subcutaneous calcifications were seen about the interphalangeal, metacarpophalangeal and wrist joints. Osteoporosis was found only in the upper humeri. The skull also showed no osteoporosis. The jaws were edentulous. Examination of the kidney region showed no renal calculi. Heavy unsegmented calcification in the posterior tibial and first plantar metatarsal arteries was seen.

Laboratory findings were as follows: nonprotein nitrogen 76 mg. per 100 cc.; serum calcium 10.5 mg. per 100 cc.; serum phosphorus 10.9 mg. Alkaline phosphatase 3.5 units (King-Armstrong).

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THE USE OF A PRELIMINARY ROENTGENOGRAM OF THE ABDOMEN IN THE DIAGNOSIS OF CONGENITAL OBSTRUCTION OF THE INTESTINE*

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MORE attention is being given to congenital abnormalities since improved surgical techniques are now available for their correction. Foremost among these correctable anomalies are those affecting the cardiovascular system and the gastrointestinal tract. Roentgenologic methods of examination have played a major part in the early and accurate diagnosis of these congenitally malformed states.

The necessity for the early diagnosis of congenital obstruction of the intestine cannot be too strongly emphasized. Congenital intestinal obstruction is a special type of emergency; operation must be done within the first week of life if the infant is to have any chance of survival and preferably should be done by the second or the third day.[1]

The condition of congenital intestinal obstruction is sooner or later suspected clinically although valuable time is usually lost before the patient is sent to the roentgen department for an examination. The persistent vomiting which may or may not be projectile, and the abdominal distention in the newborn infant arouse the pediatrician's suspicions. The vomitus is usually bile stained since most of the obstructions (about 85 per cent) will be somewhere in the intestinal tract distal to the ampulla of Vater. In corollary any meconium which may be passed is without bile. Aside from the clinical findings, the most important single diagnostic procedure is the abdominal preliminary film which will not only demonstrate the presence of the obstruction but will localize it with more than a fair degree of accuracy.

GENERAL DISCUSSION

Calder[4] is credited with the first description of a case of congenital intestinal obstruction (duodenal) in 1733. The generally accepted figures on incidence are those of Webb and Wangensteen[18] who state that congenital intestinal obstruction of all types occurs in 1 out of every 20,000 births. These same authors found the condition to be present in 15 out of 15,000 autopsies, and uncovered approximately 500 cases in the literature up to 1931. Cohen[5] stated that about 150 other cases had since been reported up to 1941. Ladd[12] and others[7] are of the opinion that congenital intestinal obstruction is more common than is generally assumed, and point out that the condition is being more frequently reported. These facts make it apparent that the importance of the condition cannot be passed over lightly.

The relative frequency of obstruction in different regions of the intestine is of interest. Probably the most accurate would be the analysis of 392 cases by Davis and Poynter in 1922:

Duodenum above papilla	59	15%	
			33%
Duodenum below papilla	75	18%	
Jejunum	60	15%	
Ileum and cecum	101	25%	
Colon	39	10%	
Multiple areas	67	17%	
Total	392		

There is general agreement that no sex predilection exists in congenital intestinal obstruction. When one surveys the literature it becomes obvious that a relatively equal number of males and females are affected. Cohen[5] observed the high incidence of mongolism associated with congenital intestinal obstruction.

Bradsky[2] reports that he found the condition to occur in two members of the same family. This is the only evidence of a possible hereditary factor.

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The abdominal preliminary film has long been recognized as the procedure of choice for the diagnosis of intestinal obstruction in adults. Many writers[5,11,18] have recommended its use in the diagnosis of congenital intestinal obstruction. The diagnostic significance of the preliminary film is illustrated in the following cases:

Obstruction Associated with Volvulus of Midgut and Malrotation of Colon. Congenital intestinal obstruction may be either intrinsic or extrinsic in nature. Ladd,[12] in a report of 60 cases, found the cause to be intrinsic in 40 and extrinsic in 20. In the duodenum, however, Forshall[9] found extrinsic causes for the obstruction to be the most common in a proportion of 3 to 2. This is due to those extrinsic obstructions caused by anomalous bands that are prone to occur in the duodenal area, but more especially to volvulus of the midgut associated with malrotation of the colon. The cecum in these cases is located on the left side below the body of the stomach; the normal attachment of the mesentery is weakened and the mesentery is fixed at a single point below the origin of the superior mesenteric artery.[3] Under these circumstances the small intestine is prone to twist itself around the axis of the superior mesenteric artery, usually in a clockwise fashion, and a volvulus of the midgut results. Ladd and Gross[13] have pointed out that there is evidence early of duodenal obstruction, followed by a marked distention of the jejunum and ileum as they become involved in this massive closed-loop obstruction of a volvulus type. Bloody stools are likely to occur in this condition after the volvulus forms. Caffey[3] pointed out the common association of anomalous peritoneal bands in the duodenal area with malrotation of the colon.

Case 1. *Anomalous Peritoneal Bands and Malrotation of Colon.*

A. E. B., a two week old colored female who had vomited persistently since birth, had failed to gain weight, and had lost steadily from her birth weight. Abdominal distention was evident and the general appearance was that of a malnourished and seriously ill infant.

Roentgen studies are shown in Figure 1. The preliminary film suggested a high obstruction with marked distention of the stomach. Contrast studies localized the obstruction in the duodenal area. A barium enema demonstrated a malrotation of the colon with the cecum lying below the body of the stomach. In view of the evident duodenal obstruction associated with the colonic malrotation, one would need to consider volvulus of the midgut around the axis of the superior mesenteric artery or obstructing peritoneal bands as the cause of the duodenal obstruction. Caffey[3] has indicated that the above two causes may operate singly or together in duodenal obstruction with associated malrotation of the colon.

On surgical exploration in this case, obstructing peritoneal bands were found. These were separated and air and fluid were then seen to pass freely into the jejunum. The cecum was located in the left upper abdomen, and was freely movable and not well fixed. The entire midgut was freely movable and although no volvulus was evident at surgery, it was postulated that it could easily have occurred. The patient died about ten hours after surgery. No doubt her extremely debilitated state was inadequate to cope with the rigors of the surgical procedures. This is an example showing that congenital intestinal obstructions must be operated upon early before irreversible changes through vomiting and malnourishment supervene.

Case 11. *Massive Volvulus of the Entire Midgut with Duodenal Obstruction.*

I. M. O., a newborn, was admitted because of marked abdominal distention, vomiting of bile-stained material, obstipation and prematurity. Only one small meconium stool had been passed.

An upright film of the abdomen is shown in Figure 2. There is a fluid level in the stomach but no fluid levels in the greatly distended small intestinal loops are noted. The small intestine is markedly widened. The absence of fluid levels in the small intestinal loops with a fluid level in the stomach may be significant of this type of obstruction. One cannot be certain whether or not colon is involved but it is definite that the major part of the small intestine is obstructed.

Surgical exploration revealed a massive volvulus of the entire midgut including jejunum, ileum, cecum, and ascending colon and proximal transverse colon. These had become twisted around the axis of the superior mesenteric artery. An extreme mobility of the intestine due to a lack of peritoneal fusion was noted. The infant died two days after surgery.

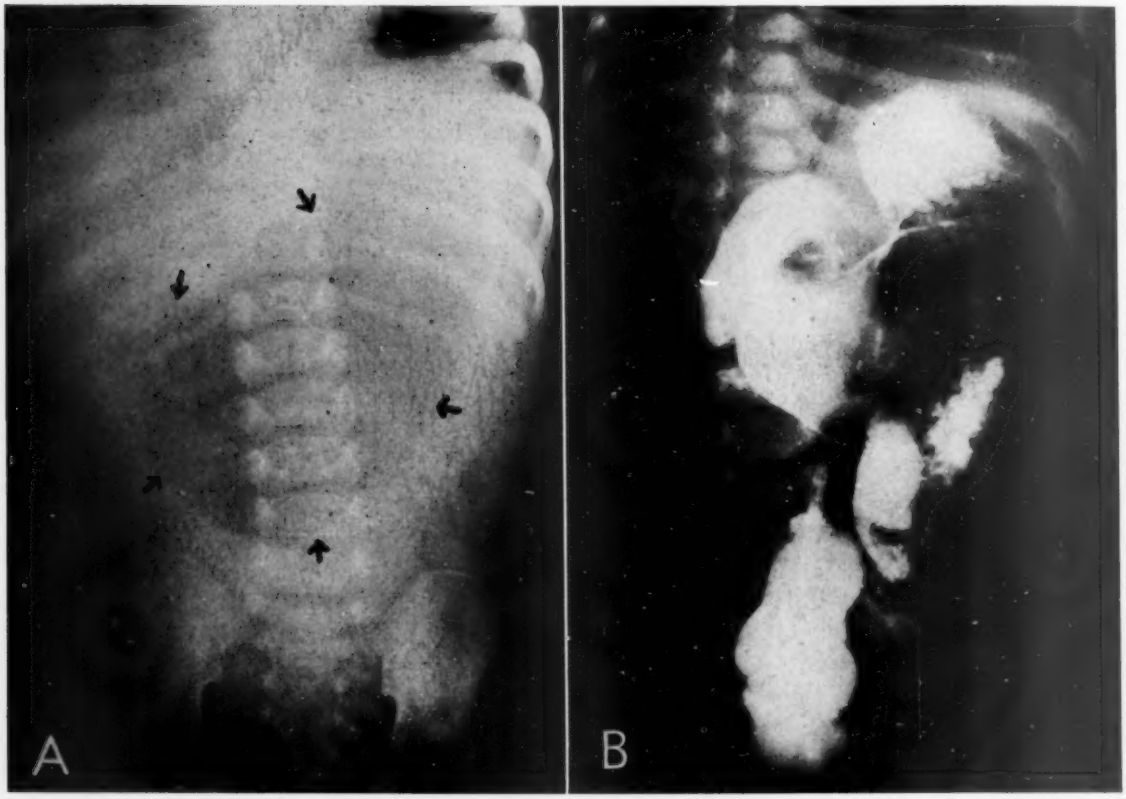

FIG. 1. Case 1. (*A*) Preliminary film shows a markedly dilated stomach (arrows). The only gas in the intestine distal to the stomach are the three small blebs in the region of the descending colon. The findings suggest a high and practically complete obstruction. (*B*) Barium enema shows malrotation of the colon with the cecum on the left side beneath the body of the stomach. Thin barium given by mouth shows a high grade gastric retention with obstruction localized to the duodenal area. The clue to the correct diagnosis is the colonic malrotation with which obstructing peritoneal bands over the duodenum and volvulus of the midgut are prone to occur. These may operate either singly or together.

Obstructions Due to Atresia and Stenosis. Intrinsic obstruction is produced either through an atresia or a stenosis of the intestinal lumen. Of these, atresia is the more common. Forssner[10] in 1907, reviewing 134 cases of congential intestinal occlusion, found atresia in 114 and stenosis in 20. The etiology is obviously that of the majority of congenital afflictions in the sense that the anatomic cause of the intrinsic obstruction represents a persistence of a phase of development which is normal for a certain embryologic period. Ladd[12] calls attention to the fact that up to the fifth week of fetal life the intestine is a hollow epithelial-lined tube. Then a proliferation of this epithelial lining with a subsequent obliteration of the lumen occurs. This stage persists up to about the tenth week at which time vacuoles appear and coalesce and by the twelfth week a permanent lumen is again established. Thus, intrinsic obstruction results from a failure of a complete recanalization of this epithelial tube. Atresia indicates an imperforate intestinal diaphragm or a solid occluding epithelial plug, whereas stenosis results when small channels exist through these diaphragms or plugs.

Ladd[12] and others[11] have pointed out that in atresia the intestine below the point of obstruction appears as a small cord, though it has all of its elements including a narrow lumen. Since amniotic fluid has never passed beyond the site of the obstruction, this distal intestine remains collapsed and

narrow. Richter[16] maintained, and others[17] have supplied evidence to support his contention, that this lower segment is actually capable of a normal expansion under moderate pressure. This is an extremely important point surgically, in the sense that an anastomosis would be useless if the intestine distal to it were incapable of expanding and assuming a normal function.

Fig. 2. Case II. Upright film of the abdomen shows a fluid level in the stomach (arrows). There is a remarkable distention of the small intestine with gas, but no fluid levels are seen. Note the width of the intestinal loops (between arrows). Possibly the absence of fluid in the small intestine signifies obstruction due to volvulus with no liquid entering the intestine from above. At surgery a massive volvulus of the entire midgut with subsequent duodenal obstruction was found.

Case III. *Duodenal Atresia.*

I. F. G., a full term white female infant, had experienced a persistent vomiting of greenish fluid since birth along with a marked degree of abdominal distention. No meconium was passed. A preliminary film (Fig. 3) taken on the sixth day of life revealed a marked distention of the duodenum to the ligament of Treitz. No intestinal gas distal to this was seen. The roentgen impression was complete congenital duodenal obstruction most likely due to a duodenal atresia. Duodenal stenosis would not be apt to produce complete obstruction early and some gas would have passed the obstructed site into the remainder of the intestinal tract. At surgery a complete obstruction due to atresia was found and a duodenojejunostomy was performed. The infant died three weeks following surgery.

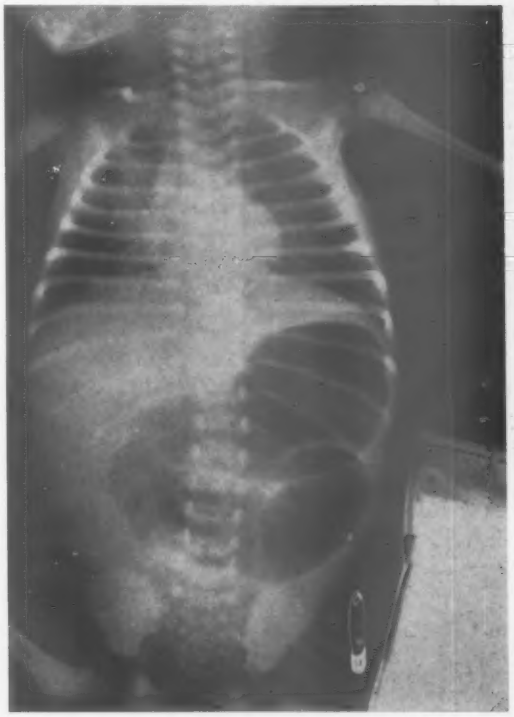

Fig. 3. Case III. Preliminary film shows a marked distention of the stomach and the duodenum to the ligament of Treitz. No gas is seen in the intestine distal to this. This is the classical preliminary film appearance of a complete duodenal obstruction, and since the condition was present since birth and obstruction is obviously complete, it is most likely due to duodenal atresia.

Case IV. *Jejunal Atresia.*

I. M. R. was a 5 lb. male Negro infant, delivered with some difficulty. The baby was weak, listless, and did not cry. An extreme degree of molding of the cranial bones was noted, and clinically a subarachnoid hemorrhage was strongly suspected. Abdominal distention was noted from the first and a persistent vomiting of greenish fluid after each feeding occurred. On the second day a preliminary film elicited the findings seen in Figure 4. Barium enema ruled out obstruction of the colon and distal ileum. The colon was of small caliber and similar to the "micro-colon" described by Hunt[11] as always

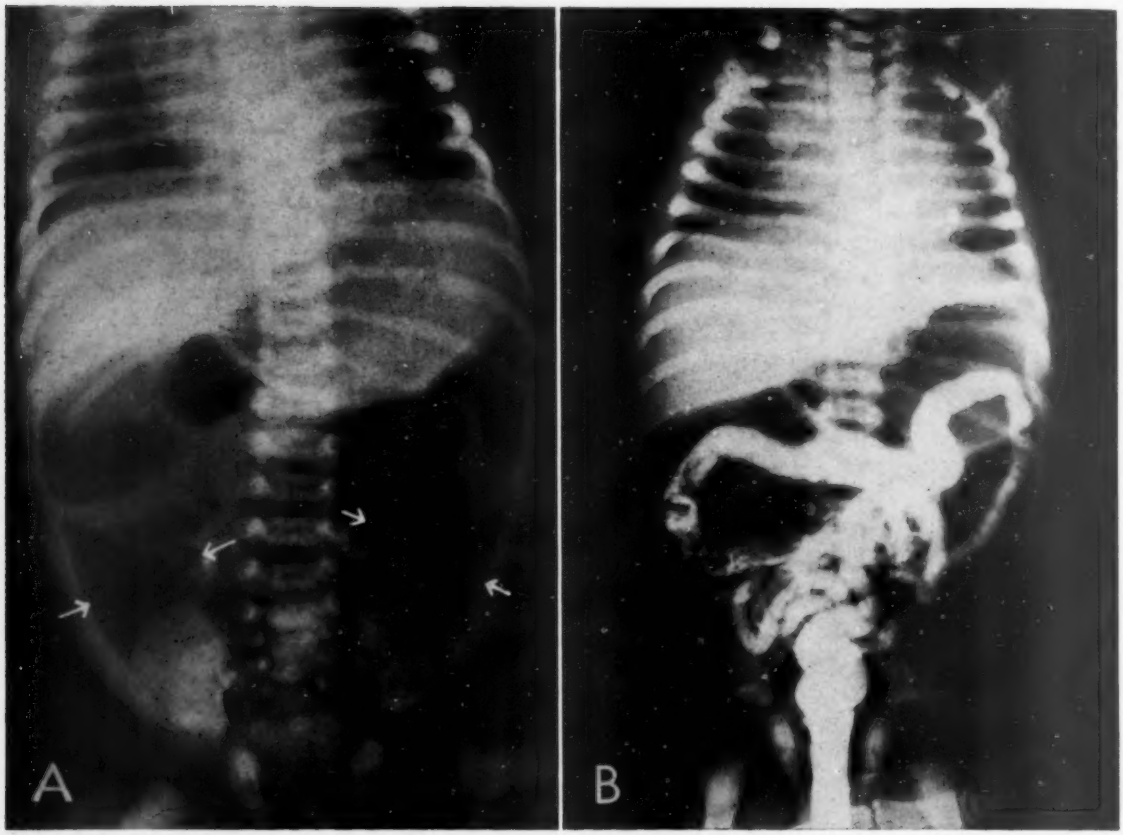

FIG. 4. Case IV. (*A*) Preliminary film shows several loops of greatly distended intestine, the width of which is considerably widened (arrows). The outer borders of the dilated intestine are smooth, making one consider ileum but the shadows cast by the plicae circulares of the jejunum could well be lost in intestine dilated to this degree. (*B*) A barium enema eliminated the colon and distal ileum as the sites of obstruction. The caliber of the barium-filled intestine is narrowed and consistent with the "micro-colon" described by Hunt as being found in cases of complete congenital small intestinal obstructions. Autopsy disclosed a complete atresia of the jejunum with the bowel terminating in a blind cul-de-sac.

being associated with complete small intestinal obstruction where amniotic fluid has never passed entirely through the intestinal tract. The diagnosis of complete small intestinal obstruction was made, but the infant died before surgery could be performed. Autopsy disclosed a large subarachnoid hemorrhage and complete atresia of the mid-jejunum which actually terminated in a blind cul-de-sac. The intestine distal to this was quite narrow, but as shown in Figure 4*B*, it distended on filling with barium enema.

CASE V. *Diaphragm Occluding the Proximal Ileum.*

I. B., a newborn, admitted because of abdominal distention, obstipation, and vomiting of bile-stained material. A film of the abdomen made on the second day of life is shown in Figure 5. The essential roentgen feature is the marked widening of the gas-distended intestinal loops.

Surgical exploration revealed a complete obstruction of the upper ileum due to an occluding diaphragm. A second diaphragm was found 2 cm. below the first. Resection of the involved intestine was done, but the infant died seven days afterward. The case is another example of the tendency for congenital obstructions to involve multiple areas of the intestine.

CASE VI. *Duodenal Stenosis and Ileal Stenosis.*

A. E., a fourteen day old, full term male infant, who since birth had vomited persistently and had lost steadily from his birth weight. The father stated that the infant was badly constipated and had bowel movements only at three or four day intervals. Physical examination

Fig. 5. Case v. Preliminary film. The essential roentgen features are the gas-distended loops of intestine, the lumens of which are abnormally widened. The findings are sufficient to warrant the diagnosis of complete congenital intestinal obstruction.

showed definite mongolism, possible congenital heart, and marked abdominal distention. A film of the abdomen taken on the fourteenth day of life is shown in Figure 6 along with contrast study of the stomach and proximal duodenum with lipiodol. The pyloric canal could be identified as a persistent narrow channel proximal to a markedly distended first and part of the second portion of the duodenum. Lipiodol entered a narrow stenotic channel but was completely obstructed in this area. A barium enema showed no malrotation of the colon. Since the condition had been present from birth, it was obvious that an atresia was thereby eliminated; a normally placed colon made volvulus and congenital duodenal bands seem unlikely; the most probable diagnosis was thought to be a duodenal stenosis which during the first weeks of life had caused an incomplete

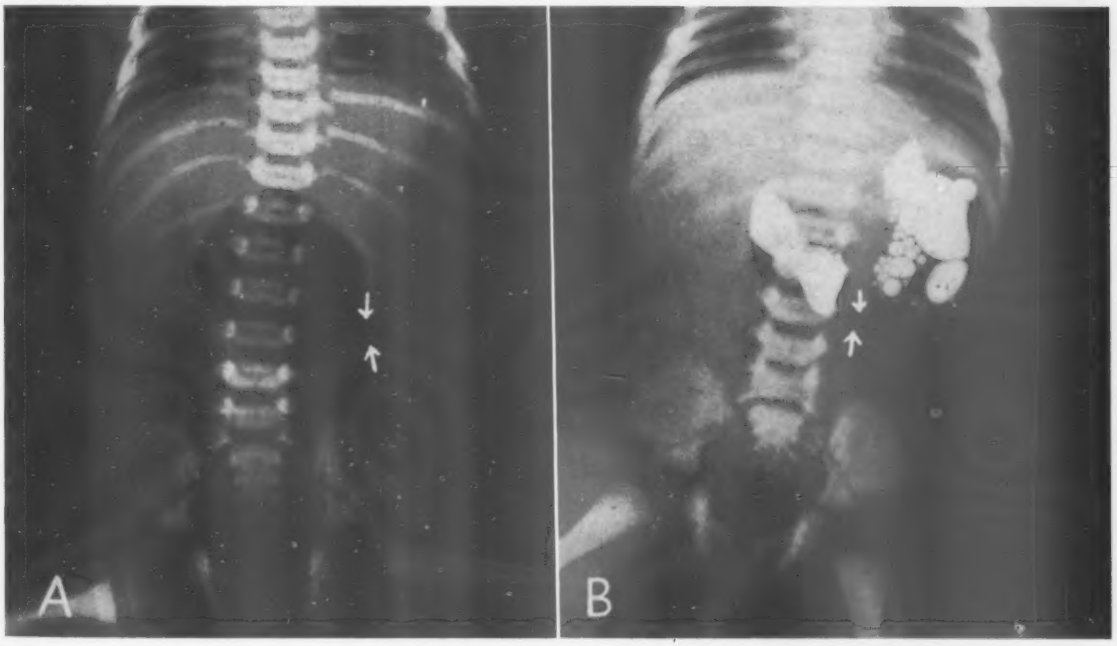

Fig. 6. Case vi. (*A*) Preliminary film shows complete obstruction at about the middle of the second portion of the duodenum. The duodenum proximal to the obstructed site is tremendously dilated; the pyloric canal is delineated (between arrows) and establishes an essential diagnostic feature, since a hypertrophic pyloric stenosis is thereby eliminated. The gas-filled body of the stomach can be seen in the left upper quadrant. No intestinal gas can be seen beyond the obstructed site indicating that the obstruction is now complete. (*B*) Contrast studies with lipiodol identify the pyloric canal (between arrows). The medium passed into the dilated duodenal bulb, but was arrested in the second portion of the duodenum terminating in a narrowed stenotic area. The roentgen impression was duodenal stenosis, which was substantiated at surgery.

obstruction, but now a total obstruction had developed. At surgery a duodenal stenosis was found and a gastrojejunostomy was done. The infant experienced a remarkable improvement and after allowing time for surgical healing was placed on oral feedings.

This infant continued to be clinically free of symptoms. A preliminary film of the abdomen is shown in Figure 7. One notes distended small intestine in the right lower quadrant having smooth outer borders and believed to represent ileum. The degree of distention of these ileal loops suggests a partial intestinal obstruction. A small intestinal study supported this opinion.

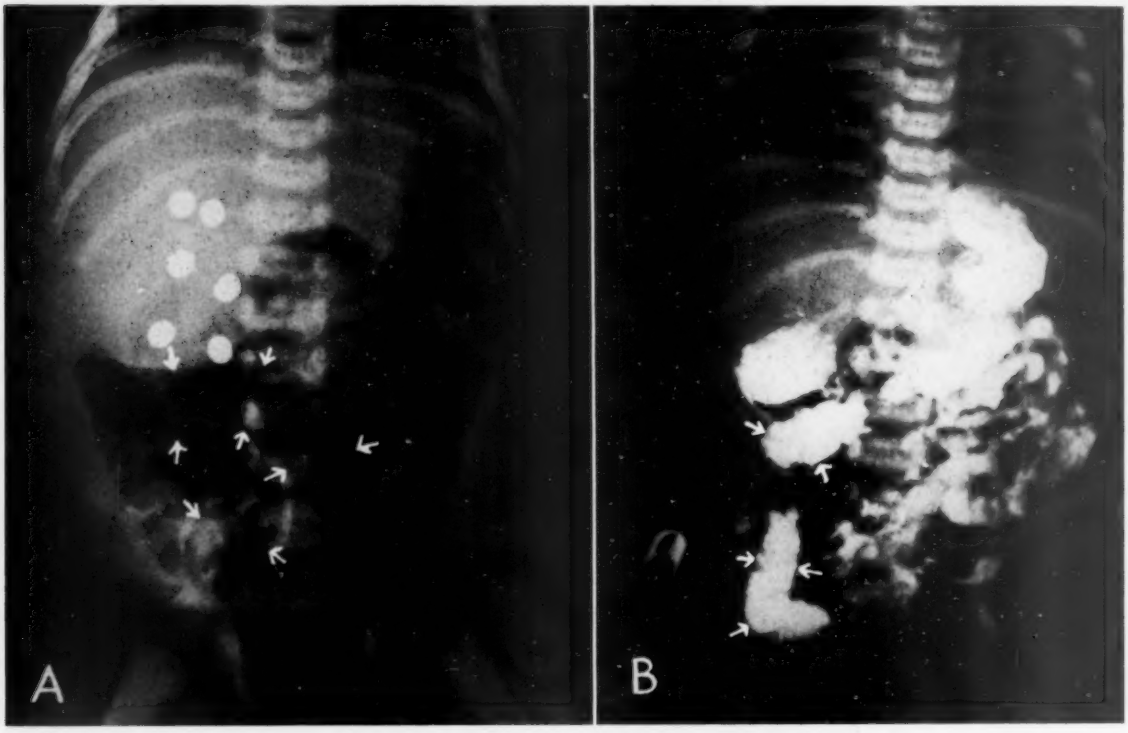

FIG. 7. Case VI. (*A*) Preliminary film after a gastrojejunostomy had been done. An essentially normal intestinal gas pattern is shown except for distended loops of ileum in the right lower quadrant (arrows). (*B*) A small intestinal study confirmed the impression that these loops were above the normal caliber. It was believed that a second area of intestinal narrowing (probably low grade) was present in the distal ileum.

An uncontrollable diarrhea developed about six weeks after surgery and death occurred seven and a half weeks following surgery. Autopsy disclosed an interauricular septal defect, stenosis of the second portion of the duodenum, the surgically created gastrojejunostomy, and an area of intestinal narrowing of the distal 10 cm. of the ileum. Ileal loops proximal to this were dilated as shown on the roentgenograms.

This case indicates that a careful search of the entire intestine must be made since about 15 per cent of congenital intestinal occlusions involve multiple areas of the bowel.

CASE VII. *Imperforate Anus.*

R. L. F., a Negro male infant, was brought into the hospital by the father five hours after birth because of marked abdominal distention. Examination revealed an imperforate anus. A preliminary film of the abdomen is shown in Figure 8*A*. The tremendously enlarged segment of intestine outlined by arrows was thought to represent cecum, and other loops of gas-distended large and small intestine were noted. It is now a well recognized fact among roentgenologists that in low colonic obstructions the cecum is the segment of large intestine to show the greatest degree of dilatation. This is believed to be due to the thin and poorly developed muscular wall of the cecum. A dime was placed over the anal dimple; the infant was then inverted and a film made in an attempt to determine the width of tissue which would be necessary to go through in order to correct this

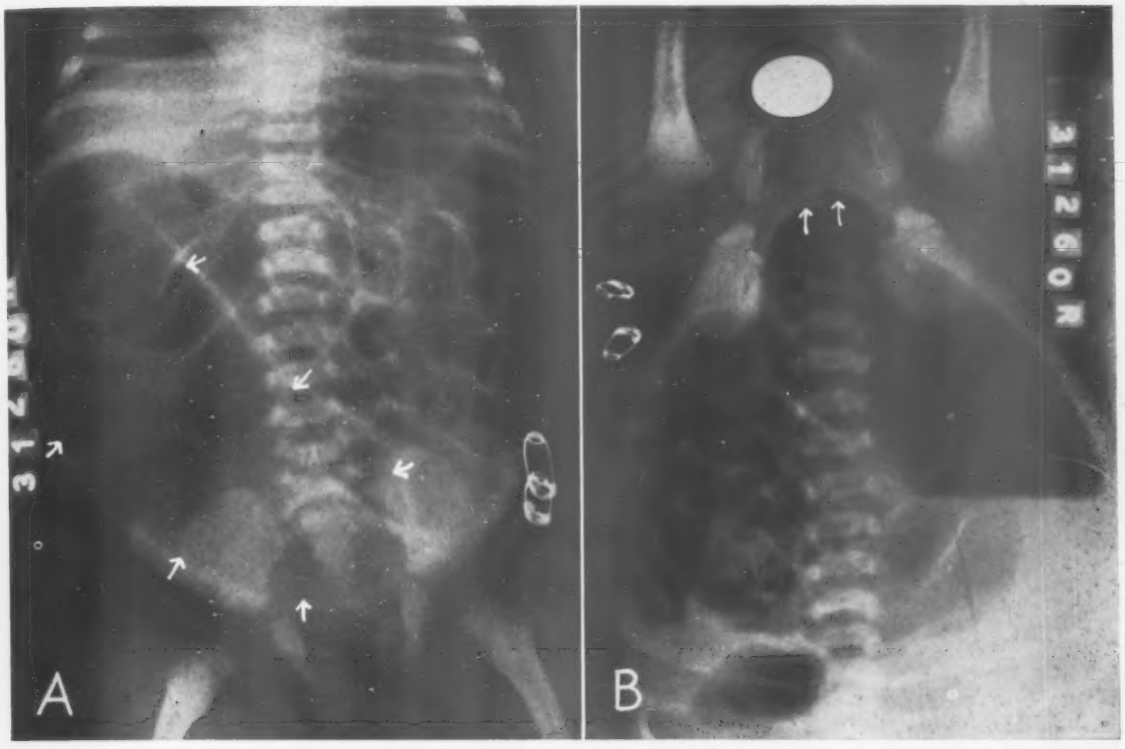

Fig. 8. Case vii. (*A*) Preliminary film demonstrates marked distention of both large and small intestine with gas. The tremendously dilated cecum is delineated between arrows. (*B*) A film made with the infant inverted and a dime placed over the anal dimple reveals a considerable amount of tissue between the latter and the lower sigmoid (arrows). A fluid level is now evident in the cecum.

anomaly. The result is shown in Figure 8*B*. What is believed to represent sigmoid colon is seen as a darker gas shadow behind the cecum; the width of tissue between the sigmoid and the outside is considerable. Surgical exploration substantiated the impression that the greatly distended loop of intestine was cecum and a colostomy was done.

This case exemplifies the known fact that the cecum is prone to show the greatest distention in low colonic obstructions; a distention that is all too frequently followed by perforation.

Congenital Obstruction Associated with Diaphragmatic Hernia. Massive herniation of the contents of the abdomen into the pleural cavity produces for the most part symptoms referable to respiratory embarrassment. Evans[8] has indicated that some cases of congenital diaphragmatic herniation are accompanied by intestinal obstruction. He describes a case[8] in which perforation of the stomach occurred secondary to the obstruction.

Case viii. *Gastric Obstruction with Diaphragmatic Hernia.*

I. F. D., a full term white female infant, had experienced respiratory difficulty and marked shortness of breath since birth with cyanosis. All feedings were promptly movited. A preliminary film of the abdomen and chest is shown in Figure 9. Multiple gas-filled bleb-like shadows are seen in the right pleural cavity, and these can be traced downward into the abdomen along the right lateral abdominal wall. The stomach is markedly distended and fills almost the entire abdominal cavity.

The infant died on the second day of life; the vomiting was never alleviated and clinically obstructive symptoms were prominent. Autopsy disclosed an absence of the right diaphragm with liver and intestines in the right pleural space. A marked distention of the stomach was found but the pathologist reported no organic cause for the gastric obstruction. Possibly a

torsion of the duodenum had been present during life.

Infantile Hypertrophic Pyloric Stenosis. Pediatric authorities[3,8] agree that infantile hypertrophic pyloric stenosis is the most

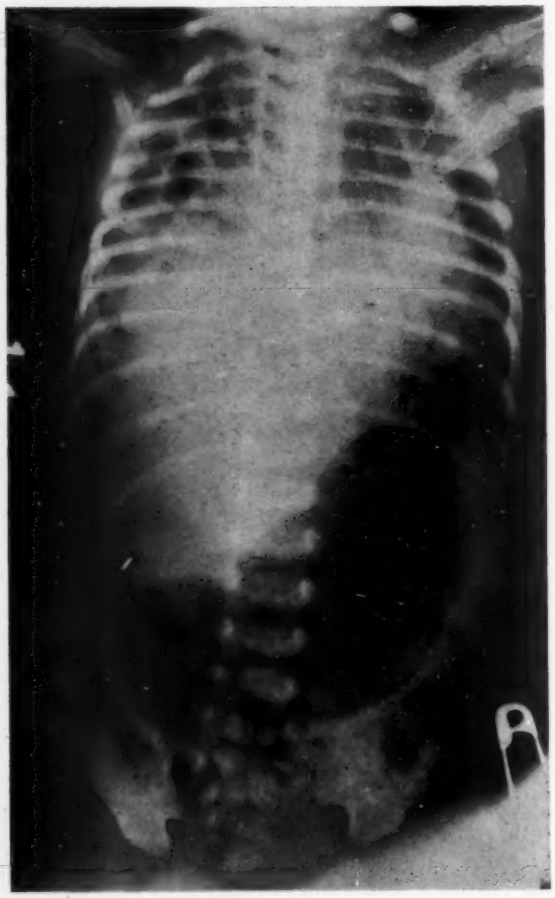

Fig. 9. Case VIII. A preliminary film of the chest and abdomen reveals a markedly distended gas-filled stomach which almost completely fills the abdominal cavity. There is an increased density over the right chest, throughout which are seen rounded roentgen-negative shadows which extend downward along the right lateral abdominal wall. The findings indicate a herniation of the abdominal contents into the right chest and associated with this is a rather marked gastric obstruction.

common and important gastric lesion of early life. Evans[8] does not consider the lesion to be truly congenital and its behavior is in fact considerably different from most congenital lesions. Evans found 50 per cent of 400 cases of alimentary obstruction in infancy to be due to hypertrophic pyloric stenosis. The incidence rises sharply to reach a peak in the fourth to sixth week of life. The diagnosis is obvious clinically on palpation of a tumor in the pyloric area associated with a pernicious projectile vomiting. Roentgen findings will demonstrate gastric retention of barium four and six hours after ingestion and in a favorable case an elongated and narrowed pyloric canal can be identified.

Case IX. *Infantile Hypertrophic Pyloric Stenosis.*

R. A. B., a five week old male infant, had been vomiting for two weeks prior to admission. In the hospital a pernicious projectile vomiting not relieved by atropine was noted. A preliminary film (Fig. 10*A*) demonstrates an enlarged and gas-distended stomach with less than the normal amount of gas in the remainder of the intestinal tract. The roentgenogram suggests a possible incomplete high obstruction. The diagnosis is established with barium studies of the upper gastrointestinal tract as shown in Figure 10*B*. A markedly elongated and narrowed pyloric canal is delineated with the thin barium mixture, indicating the presence of hypertrophied muscle in this area. All cases of infantile hypertrophic pyloric stenosis, however, do not present these classic findings. It is not uncommon for the pyloric canal to fail to visualize properly in these cases. Hypertrophic pyloric stenosis was found on surgical exploration, and a clinical cure resulted after the Fredet-Rammstedt operation of splitting the hypertropied pyloric muscle was done.

Obstruction Associated with Meconium Ileus. Meconium ileus is a type of intestinal obstruction of the newborn that deserves special attention. This is a condition associated with fibrocystic disease of the pancreas in which the meconium is thick and viscid, probably due to the pancreatic deficiency. Peristalsis is unable to push this thick meconium through the intestine and obstruction results, usually near the terminal ileum. In cases of ileal atresia meconium fills and distends the proximal intestine which may perforate with resultant meconium peritonitis. This may occur in utero,

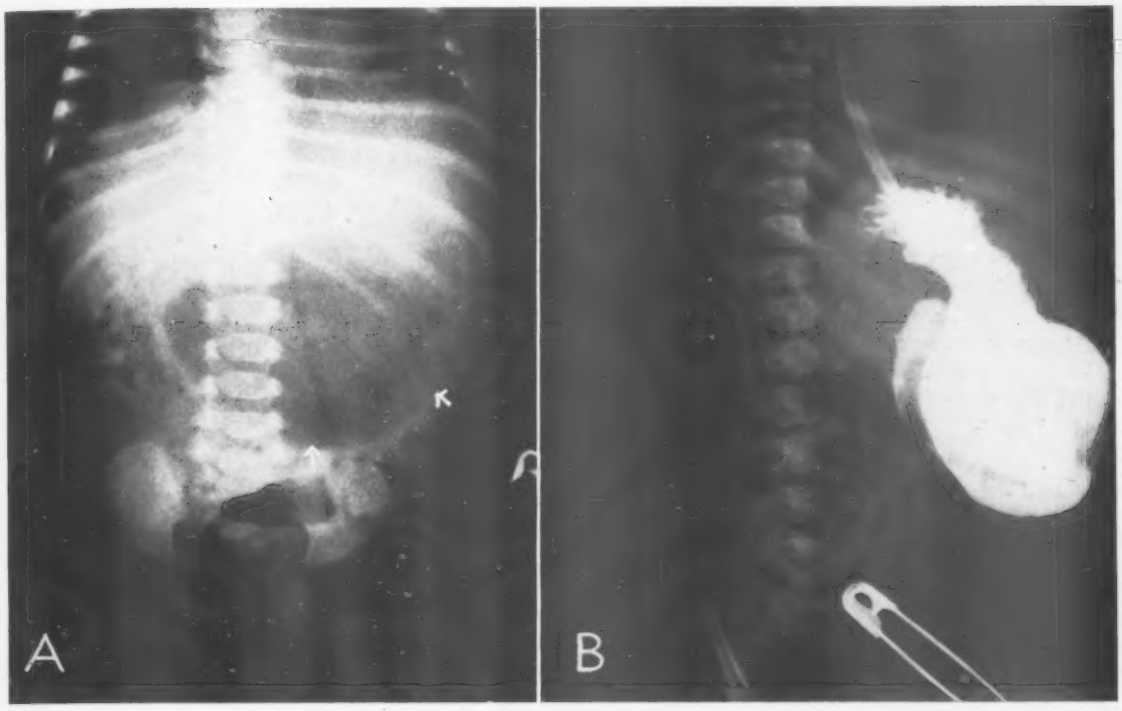

Fig. 10. Case IX. (*A*) Preliminary film of abdomen demonstrates a gas-distended stomach (arrows). The intestinal gas pattern would not be considered normal since there is less gas in the intestinal tract than one normally finds in infants. (*B*) An oblique view of the barium-filled stomach shows an elongated and narrowed pyloric segment. The film demonstrates the classic roentgen findings of infantile hypertrophic pyloric stenosis.

and Neuhauser[14] has indicated that abdominal films at birth may show linear peritoneal calcifications. Neuhauser[15] has also pointed out that meconium ileus can be strongly suspected when there is a mottled appearance of gas-filled loops of intestine as if meconium and gas were mixed together, and when there is no abrupt termination of the gas-distended intestine.

Case X. *Ileal Atresia with Meconium Ileus and Peritonitis.*

R. E. O. was admitted on the fourth day of

Fig. 11. Case X. Preliminary film shows distended intestinal loops having a greater density than if filled with gas alone. A slight mottling is present and the obstructed intestine shows no abrupt termination. The roentgen features are consistent with meconium ileus. Ileal atresia, meconium-filled proximal intestine and peritonitis were found at autopsy.

life because of persistent vomiting and obstipation. A preliminary film (Fig. 11) shows distended and slightly mottled gas-filled loops which have no abrupt termination. The degree of mottling is not as great as may be found in meconium ileus.

Autopsy disclosed an atresia of the lower ileum with the proximal intestine greatly distended and filled with thick, gelatinous meconium. The intestine distal to the atresia was quite narrow. Numerous dense adhesions were found throughout the abdomen, and microscopic section of the intestinal wall revealed peritonitis. No site of perforation was reported but undoubtedly this had occurred and become sealed.

SUMMARY

(1) Cases demonstrating the following types of intestinal obstruction are presented: duodenal atresia, jejunal atresia, ileal atresia, malrotation of the colon associated with anomalous peritoneal bands obstructing the duodenum, volvulus of the entire midgut with duodenal obstruction, imperforate anus, duodenal stenosis associated with ileal stenosis, and ileal atresia with meconium peritonitis. A case of congenital right-sided diaphragmatic hernia with all of the signs of a functional gastric obstruction, and a case of infantile hypertrophic pyloric stenosis are also included.

(2) In all of the above cases the preliminary film of the abdomen contributed essential information toward the final diagnosis.

(3) Essential roentgen features seen on the preliminary film include: gas-distended loops of intestine the caliber of which is considerably widened; when this dilated intestine shows no abrupt termination and has a mottled appearance meconium ileus must be considered. A large dilated stomach, associated with less than the normal quantity of gas in the remainder of the intestinal tract, suggests high obstruction and if a malrotation of the colon is present then volvulus of the midgut or obstructing peritoneal bands may be the cause of the obstruction.

(4) The gravity of the situation is so great that an infant who vomits persistently, has abdominal distention, and fails to gain weight in a normal fashion should have at least a preliminary film of the abdomen followed by appropriate contrast studies.

(5) For best surgical results, operation should be done as soon as possible. There seems to be an irreversibly altered chemical balance in these infants which cannot be corrected even though the obstruction is relieved.

(6) Careful search of the entire intestine must be made since about 15 per cent of congenital obstructions show involvement of the intestine at multiple sites.

The author wishes to express his deep appreciation to the entire surgical staff of the Indianapolis General Hospital and to Dr. Frederic W. Taylor in particular for permission to report the above cases.

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A SUMMARY OF FORTY-NINE RADIOLOGISTS' OPINIONS ON THE SKELETAL AGE LIMITS OF APPARENTLY NORMAL SIX-YEAR-OLD CHILDREN

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INTRODUCTION

MANY radiologists consider skeletal age to be an indicator of a child's bodily maturation age or anatomical age. Frequently, radiologists present examples of an unusual relationship which exists between a child's chronological age and his bodily maturation age as evidenced by his skeletal age. For example, Caffey[2] presents an example of one child who had a skeletal age of *six months* and a chronological age of *seven years*, and also another child who had a skeletal age of *twenty years* and a chronological age of *seven years*. The teachers in our public elementary schools would like to know what constitutes the *lower skeletal age limit* for the normal child who has a chronological age of six years and no months.

Psychologists have determined the upper mental maturity limit of normal children to be evidenced by an IQ of 110, and the lower mental maturity limit to be evidenced by an IQ of 90. This seems to indicate that psychologists agree that the normal upper and lower mental age limits of six-year-old children are approximately "six years and seven months" and "five years and six months" respectively. A child who has a chronological age of six years and a mental age which is within the limts of 6–7 and 5–6 is said to possess normal mental maturity or to have a normal mental age.

Mental age is accepted by many teachers as an important maturity age and should be included in determining a child's total maturity or organismic age as some authorities[4,6] choose to label it. It is thought that bodily maturity is an important maturation factor when one attempts to determine a child's organismic age. One radiologist[8] is of the opinion that skeletal age is the base on which all experiences are absorbed. If the preceding statement is true, it would seem then that a particular type of learning or a specific task to be learned cannot take place until the child has an adequate skeletal age. During the last two decades three sets of skeletal age standards[5,8,9] have been prepared for the radiologist's use in assessing children's skeletal ages.

The lower skeletal age limit should have significance as one of several criteria to be used in adjusting the curriculum to the child's level of growth and development. If and when the lower skeletal age limit for the apparently normal six-year-old child is determined by carefully controlled research, education will then have one more valuable criterion for determining a six-year-old child's readiness to learn at the grade level that his teacher wants to place him.

THE PROBLEM

The problem in this investigation was to determine what is thought to be the upper and lower skeletal age limits of apparently normal six-year-old children as evidenced by radiologists' opinions. It was thought that a summary of radiologists' opinions who are directors of departments of radiology in medical schools would seem to be indicative of what one may find should he attempt to obtain the needed data through carefully controlled research.

THE QUESTIONNAIRE

A questionnaire was prepared with skeletal age limits arbitrarily determined and listed for radiologists to study. The questionnaire is presented below.

DO NOT SIGN YOUR NAME ON THIS SHEET; DRAW A CIRCLE AROUND EITHER YES OR NO

Problem: What are the "normal skeletal age limits" for a six-year-old child?

1. Chronological age 6–0 { skeletal age 7–6 (upper limit) / skeletal age 4–6 (lower limit) } YES OR NO

2. Chronological age 6–0 { skeletal age 7–0 (upper limit) / skeletal age 5–0 (lower limit) } YES OR NO

3. Chronological age 6–0 { skeletal age 6–9 (upper limit) / skeletal age 5–3 (lower limit) } YES OR NO

4. Chronological age 6–0 { skeletal age 6–6 (upper limit) / skeletal age 5–6 (lower limit) } YES OR NO

THE DATA

Out of seventy questionnaires mailed to radiologists who are directors of the department of radiology in their respective medical schools, fifty-four questionnaires were returned. Five radiologists did not express an opinion. Forty-nine radiologists did express an opinion as to the skeletal age limits of an apparently normal six-year-old child. A summary of their opinions is presented in Table I and II.

A study of the data in Table I seems to indicate that the radiologists were not influenced by the writer's suggested upper and lower skeletal age limits, filling out the questionnaire according to *their* own notions as to what constitutes the limits for the normal six-year-old child.

An examination of the data presented in Table I will show that twenty-one radiologists selected 7–0 as the upper skeletal age limit and 5–0 as the lower skeletal age limit for apparently normal six-year-old children. Further analysis of the data indicates that twenty-eight radiologists differed in opinion from those who selected 7–0 and 5–0 as the normal limtis.

Eight radiologists selected 7–6 and 4–6 as the upper and lower limits while another eight radiologists selected 6–6 and 5–6 as the upper and lower skeletal age limits. Five radiologists selected 6–9 and 5–3 as the upper and lower limits.

Table I

SUMMARY OF 49 RADIOLOGISTS' OPINIONS ON THE UPPER AND LOWER SKELETAL AGE LIMITS OF AN APPARENTLY NORMAL SIX-YEAR-OLD CHILD

Ages	Number of Opinions
8–9 5–0	1
7–6 5–6	2
7–6 5–3	1
7–6 5–0	1
7–6 4–6	8
7–0 5–6	2
7–0 5–0	21
6–9 5–3	5
6–6 5–6	8
Total	49

Table II

SUMMARY OF 49 RADIOLOGISTS' OPINIONS ON THE LOWER SKELETAL AGE LIMIT OF AN APPARENTLY NORMAL SIX-YEAR-OLD CHILD

Age	Number of Opinions
5–6	12
5–3	6
5–0	23
4–9	0
4–6	8
Total	49

A study of Table II will show that twenty-three radiologists considered 5–0 to be the lower skeletal age limit for an apparently normal six-year-old child. Further examination of the data in Table II will show that twenty-six radiologists did not consider 5–0 to be the lower skeletal age limit for a normal six-year-old child.

Twelve radiologists are of the opinion that 5–6 is the desirable lower skeletal age limit. Eight radiologists declared 4–6 to be the lower skeletal age limit for the apparently normal six-year-old child, while six radiologists gave 5–3 as their choice for the lower limit of normal six-year-olds.

CONCLUSIONS AND RECOMMENDATIONS

An analysis of the data obtained in this study seems to justify the following conclusions and recommendations:

1. There is little agreement to be found among radiologists' opinions as to the lower skeletal age limit of the apparently normal six-year-old child.

2. An examination of the opinions obtained in this study seems to indicate that teachers may use 5–0 as the lower skeletal age limit for the apparently normal six-year-old pupil until standards which have been determined through carefully controlled research are made available.

3. The lower skeletal age limit for the apparently normal six-year-old child should be used as a criterion along with such criteria as mental age, reading readiness status, nutritional status, sensory defects status, social development, emotional development, experiential development, *et cetera*, in determining a child's readiness for learning a specific task or area of subject matter.

4. Through this survey it was discovered that there is a medical school in a large university that is working on this problem. This medical school is studying children from the kindergarten through the twelfth grade in order to determine the lower

skeletal age limits of children who have chronological ages of 6–0, 7–0, 8–0, etc.

5. The upper skeletal age limit of normal six-year-old children is thought to be an unimportant maturity age limit, having value only when the evidence seems to indicate that a particular child is accelerated in his growth and development and, therefore, his learning may be more effective if the tasks to be learned are suited to his apparent ability.

6. Directors of departments of radiology in our large medical schools may find it profitable for their students if they provide more intensive training in assessing roentgenograms of children's hands and wrists for determining bodily maturation, endocrine dysfunction, removal of labile minerals, physiological maturity, *et cetera.*

7. Radiologists should assess all roentgenograms of children's wrists and hands and make the data available for teachers. The public school teacher will then have another valuable *maturity age* to use in determining a first-grade child's readiness to learn to *read* printed words.

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RESPONSE OF CARCINOMA OF THE CERVIX UTERI TO FRACTIONATED RADIUM AND ROENTGEN THERAPY GIVEN CONCURRENTLY*

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PROGRESSIVE improvement in the control of carcinoma of the cervix uteri has been attained in nearly all radiotherapeutic centers during the past thirty years. It is to be continued through more precise integration of radium and roentgen therapy and through more discerning clinical evaluation of the patient for appropriate individualization of treatment. Progressive improvement of radiotherapeutic results from 1902 through 1941 is well illustrated in the report by Dresser and Smith from Massachusetts. Treatment of carcinoma of the cervix by radium alone gave serial five year survival rates as follows: 1902–1913, 0 per cent; 1919–1923, 16 per cent; 1924–1928, 25 per cent; and 1929–1933, 29 per cent. The addition of roentgen therapy raised the absolute five year survival rate for a 1929–1933 group of cases to 43 per cent, and for 1934–1938 up to 46 per cent in one group and to 52 per cent in another group of cases. Heyman likewise reports an improvement in absolute five year survival at the Radiumhemmet of from 21.6 per cent for the period 1914–1931 up to 39.9 per cent for the period from 1932 through 1941. Improved results have been reported by Martindale of the Marie Curie Hospital in London (44.7 per cent relative five year survival), by Waterman *et al.* (44.4 per cent relative five year survival) utilizing parametrial radium needles, and by Lampe and Miller of the University of Michigan (above 45 per cent absolute five year survival), as well as by many other radiotherapists in various cancer centers.

ANALYSIS OF CASE MATERIAL

The present review is based on 323 consecutive unselected cases of carcinoma of the cervix uteri, of which 254 were treated entirely by the Department of Radiology at the University of Nebraska Hospital, while the other 69 cases were treated in private practice at the Nebraska Methodist Hospital. Of the 323 cases, 313 were followed five years or more, providing a follow-up of 97 per cent. The 10 lost cases have been counted as dead, although the majority of these were early cases with a good prospect of survival. Our statistics are quoted entirely in terms of *absolute* known five year survival without reference to whether or not the patient subsequently developed disease. About 10 per cent of the survivors did apparently die from cancer subsequently. Death from any cause, whether cancer or otherwise, and all lost cases have been counted out in the calculation of absolute known five year survival rates.

The treatment of carcinoma of the cervix uteri by the Department of Radiology at the University of Nebraska Hospital began in 1931. The chronological distribution of the 254 cases reviewed and their subdivision as to stage and absolute five year survival are shown in Table 1 and Figure 1. The span from 1931 to 1944 is seen to divide itself roughly into three periods. From 1931 through 1936, 73 relatively advanced cases were treated primarily by radium alone with a known survival of 20.5 per cent for five years or more. From 1937 through 1941, 121 moderately advanced cases were treated concurrently by fractionated radium and roentgen therapy with a known five year survival of 42.1 per cent. From 1942 through 1944, 60 moderately advanced cases were treated by our house staff with a disconcerting fall

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of known five year survivals to 31.6 per cent. Numerous factors, some related to World War II, apparently contributed to this temporary deterioration of results which become corrected in 1945–1946, since the anticipated five year survival rate has since risen to about 50 per cent (Fig. 1). Of the 69 cases treated in private practice at the Nebraska Methodist Hospital, 66.7 per cent were known to be living five years or more after therapy. Since 1944, 82 cases have been treated at the University of Nebraska Hospital and over 100 additional cases treated in private practice, but insufficient time has elapsed for their five year evaluation.

An effort has been made to explain the widely differing known five year survival rates from the standpoints of stage of disease, the age and general health of the patient, and also according to the techniques in dosages of radium and roentgen therapy utilized. The distribution of cases according to stage of disease, age and five year results are presented in Table I. Table II presents averages of the various details concerning the application of radium sources and administration of roentgen therapy.

Analysis of Radium Therapy

Radium therapy has been administered usually as a series of two to four applications beginning in the vaginal vault and proceeding to the cervical and uterine canal. The average treatment consisted of 40 to 55 milligrams of radium applied from twenty-four up to seventy-two hours as grouped in Table II. Applications were repeated at intervals of five to eight days and all radium therapy was delivered, on an average, within a period of fourteen to twenty-four days, although varying from two to forty-five days. Radium was filtered through 1 mm. of platinum, usually being distributed in 5 and 10 mg. tubes of the French type. Applications were usually made under heavy sedation rather than under general anesthesia, although more recently anesthesia has been utilized. Intrauterine tandems were applied in a narrow rubber sac inserted along the uterine canal with minimal trauma in dilatation of the cervix. Vaginal applications were made by means of cork colpostats* of the type used at the Radium Institute of Paris. The

Table I

Comparative Analysis of Consecutive Unselected Cases

1. Free Clinic Cases Treated by Radium Alone and
2, 3. Treated Concurrently by Fractionated Radium and Roentgen Rays.
4. Private Cases Treated Concurrently by Fractionated Radium and Roentgen Rays.

	Free Clinic Cases—University of Nebraska												Private Cases—Nebraska Methodist Hospital			
	1. Radium Alone 1931–36 Av. age 47.8 yr.				2. Radium and Roentgen Rays 1937–41 Av. age 48.7 yr.				3. Radium and Roentgen Rays 1942–44 Av. age 51.8 yr.				4. Radium and Roentgen Rays 1932–44 Av. age 48.1 yr.			
Stage Schmitz	Cases		Survival		Cases		Survival		Cases		Survival		Cases		Survival	
	Per Cent	No.	No.	Per Cent	Per Cent	No.	No.	Per Cent	Per Cent	No.	No.	Per Cent	Per Cent	No.	No.	Per Cent
I	1	1	0	36.8	7	8	5	62.5	7	4	3	75.0	17	12	11	91.7
II	25	18	7		31	38	23	60.5	32	19	10	52.6	28	19	15	78.9
III	47	34	8	23.5	45	54	22	40.7	32	19	6	31.6	46	32	18	56.3
IV	27	20	0	0.0	17	21	1	4.7	30	18	0	0.0	9	6	2	33.3
All		73	15	20.5		121	51	42.1		60	19	31.6		69	46	66.7

* Obtained from Bruneau et Cie, Paris, France.

average product of milligram hours varied from 5,800 to 6,500, distributed in a ratio of from 2 to 3 up to 3 to 4 between the uterine canal and vaginal vault. It is estimated that 6,200 gamma roentgens to 7,100 gamma roentgens were delivered to point A in the paracervical triangle as designated by Tod, 2 cm. above the vault and 2 cm. lateral to the uterine canal. Roughly one-third this dosage is estimated to have been delivered to the mid pelvic wall.

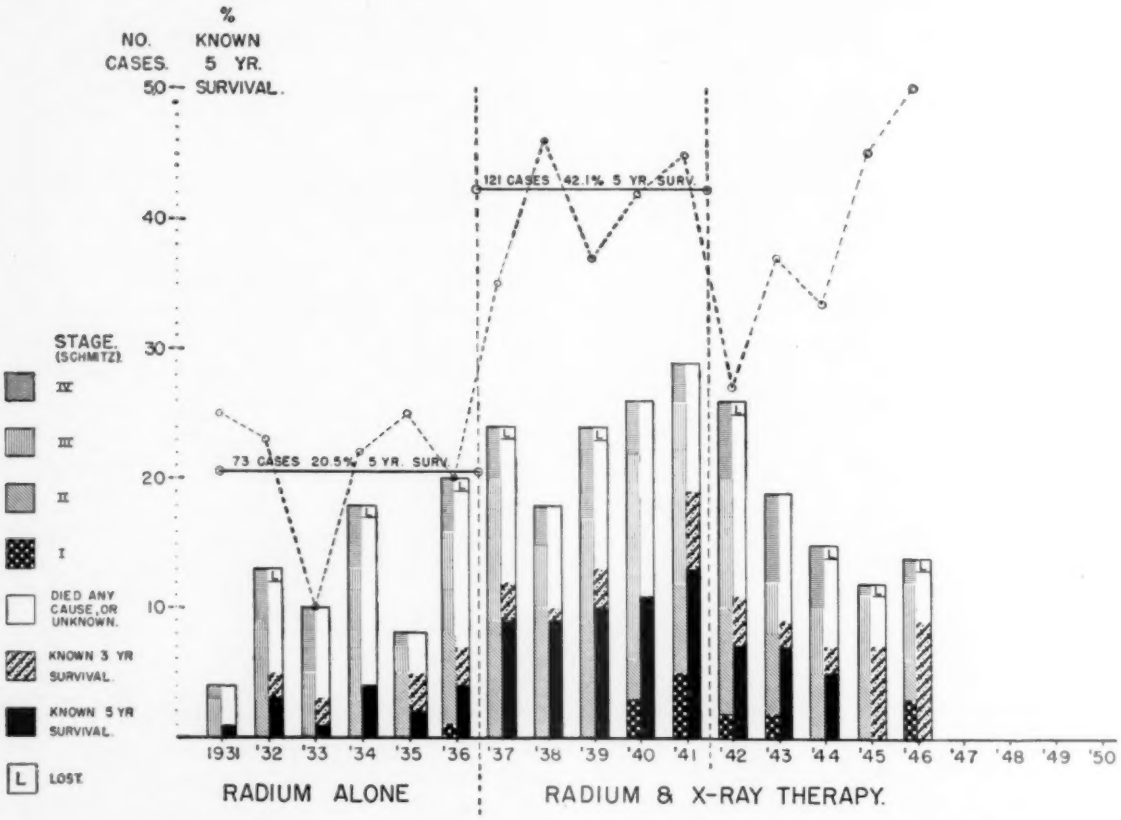


FIG. 1. Graphic analysis of 254 unselected University of Nebraska Free Clinic cases of carcinoma of the cervix uteri distributed according to year by stage of disease and showing three year and five year absolute survivals.

Review of the average value of various factors expressed and calculated in Table II reveals no significant differences to account for the wide divergence in results of the various groups of clinic cases and private patients. The period 1931–1936 was one of pioneering in the development of technique and in the accumulation of clinical experience. The total dosage of radium administered was slightly higher during this period due to the lack of supplementary roentgen therapy and the advanced stage of cases treated. No significant mathematical differences in radium dosage factors are revealed to account for the temporary deterioration of results at the University of Nebraska during 1942 to 1944 or the superior results attained in private practice. Undoubtedly certain qualitative factors inherent in the experienced placement of radium and clinical individualization of dosage contributed significantly to variations in cure rates. Such qualities are not detectable by mathematical analyses. There is something intangible in the artistry and judgment of applying radium

which comes only from analyzed experience and critical evaluation.

We emphasize that the average values for radium therapy referred to above are merely for analysis. They must not be misconstrued as representing even a generally prescribed dosage. Radium therapy has been strictly individualized with total milligram hour values varying from 2,400 to 12,200, depending upon the width of the vaginal vault, length of the uterine canal, distribution of disease, associated infection, previous surgery or irradiation, concurrent roentgen dosage, period over which irradiated and also the age and general tolerance of the patient. Various combinations of applicators, rubber sacs, cork colpostats and wax molds were fitted to meet individual problems, particularly in the Methodist Hospital series of cases. Such individualization of approach and establishment of dosage applied likewise to roentgen therapy.

TABLE II

AVERAGE RADIUM AND ROENTGEN THERAPY TECHNIQUES RELATED TO RESPONSE OF CARCINOMA OF THE CERVIX UTERI

	University of Nebraska Hospital Cases			Private Cases
	1931–1936	1937–1941	1942–1944	1932–1944
Radium averages:				
Mg. hr., canal	2,875	2,095	2,166	2,607
Mg. hr., vagina	3,605	3,657	3,842	3,413
Mg. hr., total	6,480±	5,752±	6,008±	6,020±
No. applications	2.4	4.0	3.3	2.5
Mg. per application	40	50	52	55
Duration	71 hr.	28.5 hr.	35 hr.	44 hr.
Interval	5 days	6 days	8 days	6 days
Total period	14 days	24 days	22 days	15 days
Gamma roentgens at 2 cm.	7,100	6,200	6,600	6,500
Roentgen therapy averages:				
Half-value layer		1.8 mm. Cu	1.0 mm. Cu	1.0 mm. Cu
Distance		70 cm.	70 to 50 cm.	60 to 70 cm.
Ports		3 to 4	2 to 4	2 to 4
r (in air), port		2,010±	1,680±	1,750±
Period		28 days	21 days	19 days
r, mid pelvic wall		2,950	2,250	2,300
Estimated dose to mid pelvic wall:				
Radium, gamma roentgens	2,400	2,100	2,200	2,100
Roentgens		2,950	2,250	2,300
Combined time	13 days	30 days	26 days	23 days
5 year survival (absolute)	20.5%	42.1%	31.6%	66.7%

ANALYSIS OF ROENTGEN THERAPY

Radiation was energized by 200 kilovolts and filtered through an equivalent of 0.5 to 2 mm. of copper, giving half-value layers of 0.9 to 1.8 mm. of copper. Radiation was delivered from a distance of 60 to 70 cm., except during the war period from 1942 to 1944 at the University Hospital, where distance was reduced to 50 cm. along with reduction of filtration, for conservation of time and facilities. Port

sizes, as well as the number and direction of roentgen-ray beams, varied considerably according to the size of the patient and distribution of disease, particularly at the Methodist Hospital. Patients were treated primarily through divided 17 by 21 cm. anterior and posterior ports, extending supposedly from the level of the lower symphysis to the level of the anterior superior spine. Four oblique centrally directed 10 by 17 cm. beams were utilized considerably during 1937 to 1940, but were discontinued except in patients over 25 cm. due to excessive proctitis and sigmoiditis. During 1942 to 1944, many cases were treated through large anterior and posterior ports divided by a lead strip, which has since been altered due to vaginal recurrences and a wide variation away from the midline of individual radium placement. Roentgen therapy was administered over average periods of eighteen to twenty-eight days, being delivered consecutively with applications of radium. Combined roentgen and radium therapy was administered during average periods of twenty-three to thirty days. The average values of roentgens in air per port varied widely and the number of portals per patient increased with the diameter of the patient and with the extent of the disease. Dosages in air per portal of 1,600 to 2,000 roentgens have caused no significant injury to the skin. The average value of roentgens delivered to the parametria and mid pelvic wall may seem to be relatively moderate; however, its biological effectiveness was considerably increased by the concurrent irradiation with radium and roentgen rays and the relatively condensed period of twenty-three to thirty days for combined therapy. Roentgen therapy to the mid pelvis became somewhat reduced during 1942–1944 due to over compensation for previous high dose effect and as a result of insufficient supervision and deterioration of facilities under wartime exigencies. No adequate roentgen therapy was available for the preponderantly advanced cases treated by radium from 1931 to 1936 at the University Hospital.

GENERAL ANALYSIS OF FIVE YEAR SURVIVAL STATISTICS

Five year survival rates reflect, not only the efficiency of treatment, but also the case material as related to stage of disease, age, general health and cooperability. Classifications of carcinoma of the cervix, as provided by the League of Nations and the Schmitz systems, seem quite rigid and definite in statement although they may be confusingly modified by individual judgment in applications. We have, in general, followed the Schmitz classification, although cases have occasionally been staged according to the League of Nations at the University Hospital. Analysis of case material, according to the Schmitz classification and patient's age, is presented in Table 1. The occurrence of relatively more early cases in a select private practice is attributable to the intelligence and initiative of the patients, as well as to the alertness and responsibility of their private physician. Furthermore, the private case group may present the additional advantages of being slightly younger, having better general health with hygienic habits, and a cooperative attitude. The case material met in any practice is subject to more or less automatic selection by extraneous factors which make intercomparison of five year survivals between various clinics, and even different years in the same clinic, unreliable as an index of the adequacy of therapy alone. A surgical clinic will attract earlier cases than a radiotherapeutic clinic. The select private practice will benefit from more favorable case material than the dispensary or free clinic practice. As shown in Table 1, the case material of clinic practice changes with economic conditions, as shown by an increase in the average age at the University Hospital from 48.7 up to 51.8 years during the 1942–1944 war period.

Deterioration of five year survivals at the University Hospital during 1942–1944

to 31.6 per cent from an average of 42.1 per cent for the previous five year period seems attributable to numerous factors. Increased average age of three years and poorer general health of patients contributed significantly. Most important, the 1945 and 64 per cent in 1946, as shown in Figure 1.

Definite improvement of five year results from 20.5 per cent for 1931–1936 up to 42.1 per cent for 1937–1941 seems attributable primarily to more effective ap-

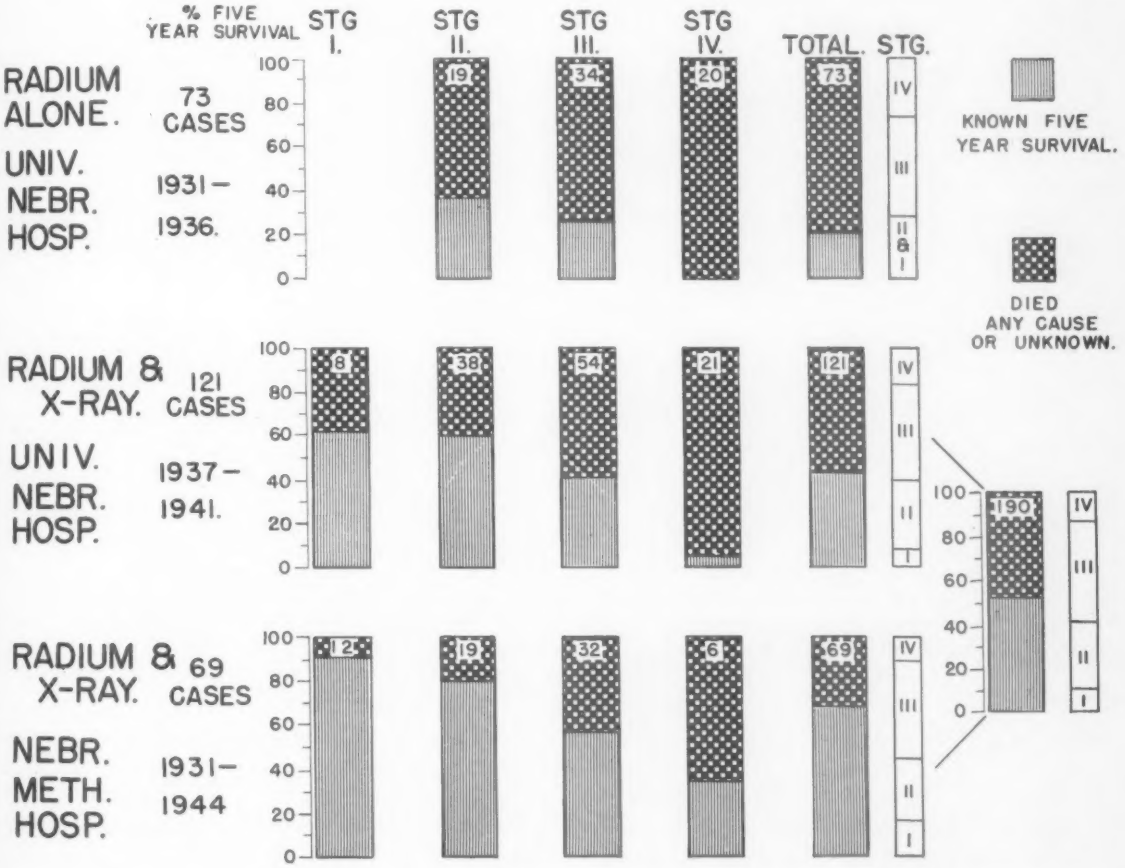


Fig. 2. Comparative analysis of consecutive University clinic and private case groups as related to stage of disease and absolute five year survival rates.

percentage of Stage IV cases increased from 17.4 up to 30 per cent. Two early cases with good prognoses were lost and one patient refused to complete treatment. Reduction in lateral pelvic roentgen dosage may have reduced control of advanced cases. Although there was no change of radium dosage in terms of milligram hours, applications may have been less effectively placed due to lack of time, experience and supervision. The three year survival rates have since renewed an upward trend from an average of 45 per cent to 58 per cent in

plication of combined radiation therapy. Addition of adequate roentgen therapy extended the cancerocidal range of parametrial dosage and raised the dose at the mid pelvic wall from 2.4 threshold erythema doses up to about 5.0 t.e.d. Undoubtedly, the increase of Stage I cases from 1.4 up to 6.6. per cent and decrease in Stage IV cases from 27.4 down to 17.4 per cent did also contribute to the improved five year survival rate. Furthermore, experience in the application of radium and clinical judgment from obser-

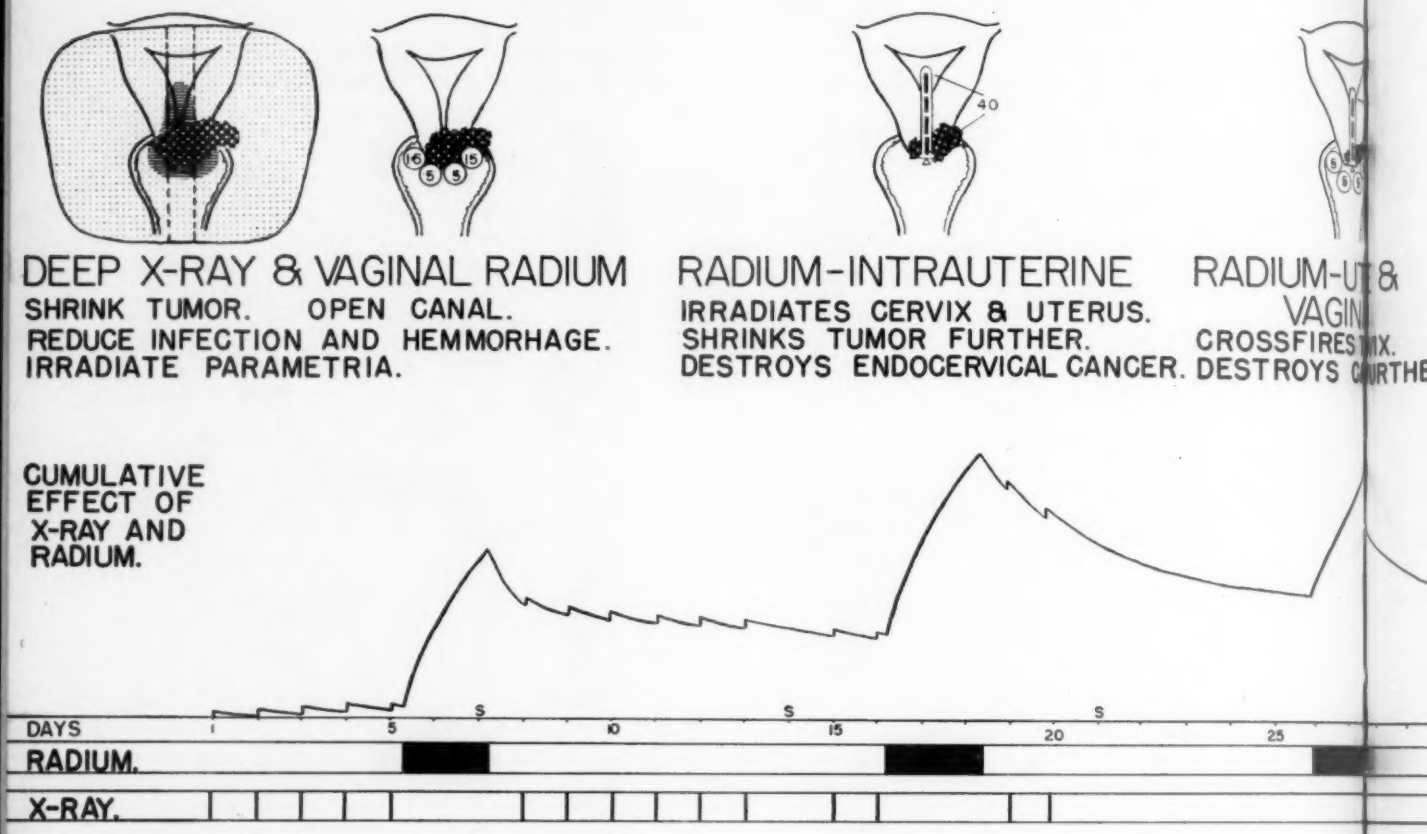
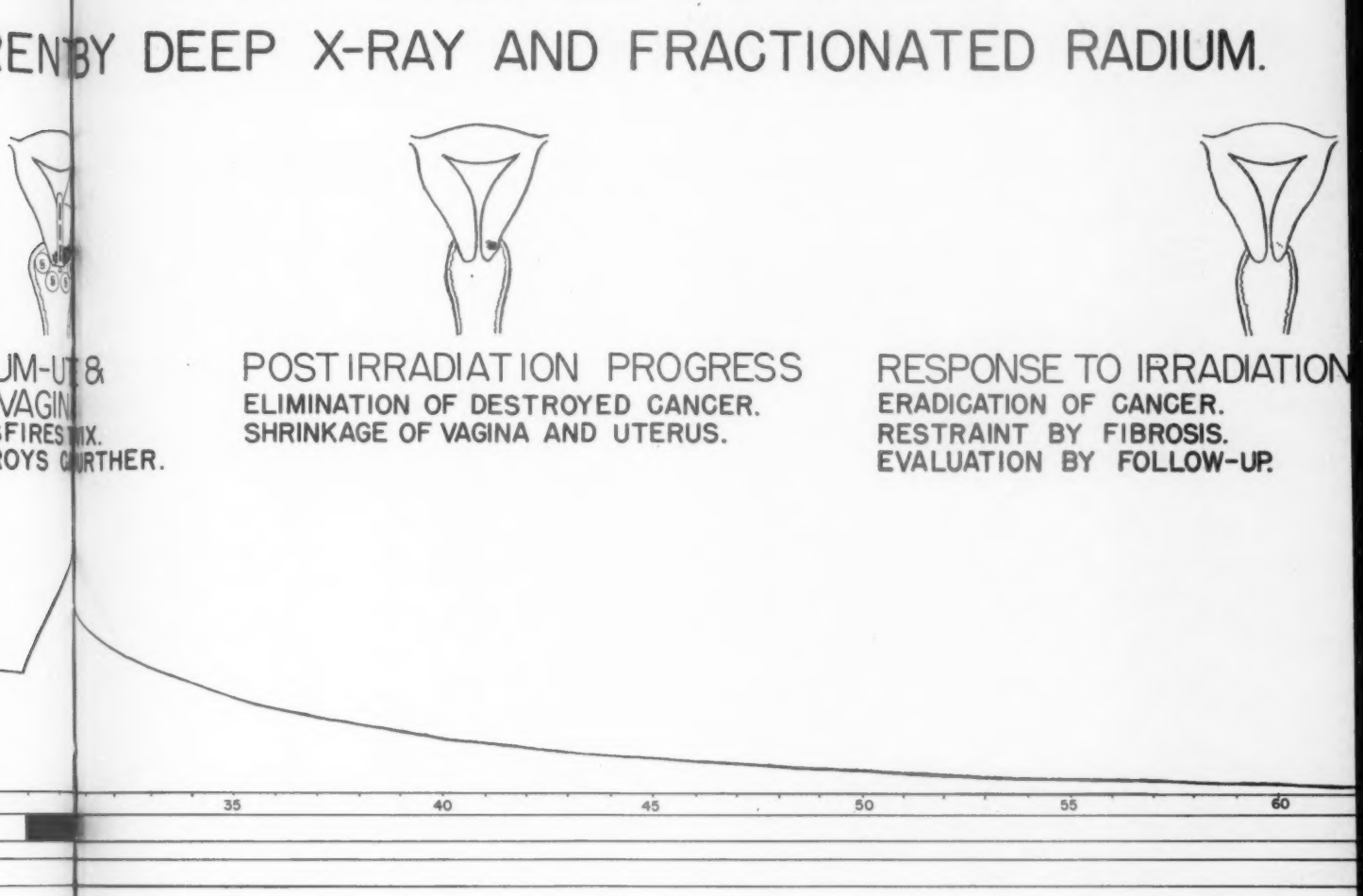


FIG. 3. Schema of radiation cumulated by fractionat adium a

vation and follow-up of those 73 cases during the first five year period provided a background for more effective management of patients during the second five year period, yielding its 42.1 per cent five year survival rate. The superior five year survival rate of 66.7 per cent obtained in the private practice group is attributed to favorable case material, with 17.4 per cent Stage I and only 8.7 per cent Stage IV cases, close attention to technical details, individualization of therapy according to distribution of disease, and graduation of dosage according to tolerance of the patient. It would appear that representative five year survival rates for proper radiation therapy for carcinoma of the cervix uteri are the University of Nebraska Clinic series, 1937–1941, and the entire private practice group as shown in Figure 2. The combination of these two groups of consecutive cases totals 190 and shows an over-all *absolute* survival rate of 51.0 per cent. The average five year *absolute* survival for all cases seen in the free clinic (181) 1937–1944, and in private practice (69) 1932–1944, is 46 per cent.

DISCUSSION OF RADIOTHERAPEUTIC PRINCIPLES

A variety of technical factors are believed to have contributed to the relatively favorable responses to the radiation therapy outlined above. The integration of radium and roentgen therapy is essential for maximum efficiency. It has been our responsibility to apply and control all radium therapy as well as all roentgen therapy.



fractionated radium and roentgen therapy given concurrently.

This placed the radiologist in complete control of the sequence and dosage of radium and roentgen rays, permitting their consecutive or concurrent application. A more effective biological dosage is accumulated in the pelvis and the patient's time and resources are conserved by the completion of combined therapy within three to four weeks.

The fractionated application of radium dosage on two or more occasions at intervals of five to eight days has numerous advantages, such as more effective irradiation of parametria, safer intrauterine placement of radium, increased cancerocidal range, better control and individualization of dosage and fewer complications (McGoogan and Hunt). Parametrial irradiation by vaginal radium is most effective when most laterally placed in the largest practical colpostat. The large colpostat increases the relative depth dosage as compared to mucosal dosage as shown by Sandler. Since the vaginal vault begins to shrink within ten days after initiating roentgen or radium therapy, such lateral applications must be made early in the course of radiotherapy. Application of radium laterally in the vaginal vault may at times precede roentgen therapy advantageously, not only for irradiation of the parametria but also for the control of hemorrhage and for the reduction of large cervical cancers. Martin advocates the electrosurgical removal of such bulky masses prior to the application of radium. Such cervical tumors can be shrunken also by transvaginal roentgen irradiation and more slowly by high voltage

external roentgen therapy. Previously obscured and often obstructed cervical canals are revealed and opened following vaginal radium therapy. The thickness of neoplasm will have been reduced following the first application, rendering the second and successive applications more effective by bringing the peripheries of the growth into the range of cancerocidal dosage. Stage I and II lesions are usually adequately and safely treated by two applications of radium, whereas Stage III and IV lesions frequently benefit from three or four applications. Vaginal colpostats should have a diameter of at least 1.8 cm. Inasmuch as roentgenograms are always taken following each radium application, prior radiation intensities are reviewed in the planning of all further applications of radium with resulting more homogeneity of irradiation. Fractionation reduces complications, not only through avoidance of over-irradiation of one particular area, but also because proctitis, enteritis or cystitis from high intensities will have made its appearance during the interval.

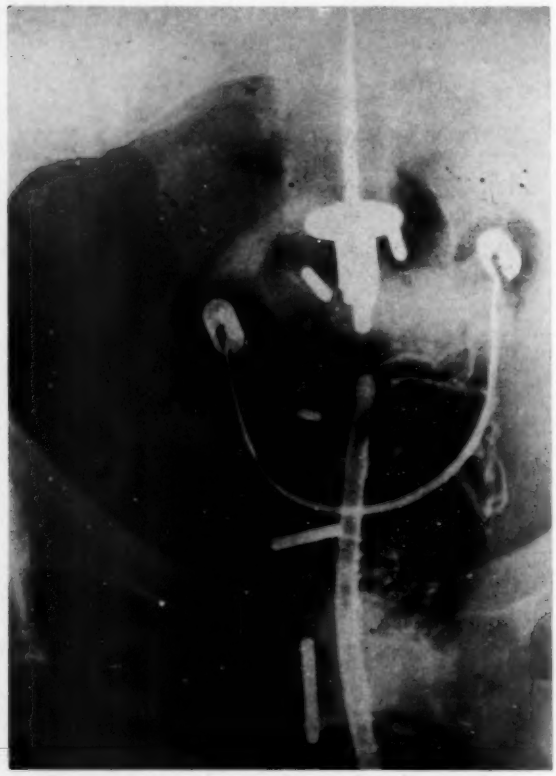


FIG. 4. Roentgenograms showing placement of Paris colpostats and corks for distribution of radium sources in a Stage III carcinoma of the cervix with right parametrial and vaginal extension. Patient well five years.

Localization of radium applicators by means of anteroposterior and lateral roentgenograms has been of great assistance in the guidance of radium applications, calculation of dosage, correlation of radium and roentgen therapy, and also in the evaluation of complications and recurrences. Immediate roentgenographic localization shows the placement and distribution of radium sources, thereby revealing indications for readjustment at the time or variation in the duration of the application according to the distribution of intensity and total dosage. Observed deficiencies can be compensated for in the planning of subsequent applications. Films taken prior to removal have rarely shown any significant shift in position. Relatively secure retention of placement has been attained by the use of zinc oxide ointment gauze, which forms a cohesive mass incorporating the colpostats and other radium applicators within it. Extrusion has been prevented by cross straps of adhesive forming an "X" across the perineum, extending from each buttock to the opposite flank. Hairy regions of the perineum and groin are covered by gauze. Emptying of the bladder is provided for by means of a Foley catheter, size 20, and the anus is left exposed for defecation. The patient is instructed to retain the packing by means of a gloved hand while straining or sitting on the bedpan.

The introduction of radium along the cervical and uterine canal has been facilitated by application of radium to the vaginal vault or preceding roentgen therapy whenever closed or obscured. Intrauterine tandems have been 6 to 8 mm. in diameter, being of small size in order to minimize trauma and reduce the hazard of dissemination. On the other hand, Schmitz advocates a thick tandem on the basis that the rela-

tive depth dose as compared to mucosal dose is increased. We are now using a plastic stem with metal collar which is more easily loaded and emptied, more readily introduced, and more securely maintained in position than were the rubber sacs previously used.

Sandler. The Paris cork cylinders, measuring 2 cm. in diameter and 3.7 cm. in length, are adaptable to vaults of various widths of from 4 to 10 cm. and provide fairly homogeneous irradiation and relatively good depth dosage. The larger Manchester ovoids, 2.5 and 3.0 cm. in diameter, give

TABLE III

A. Comparison of Survivals with Conventional and Special Radiotherapeutic Procedures

Methods	Author	Year	Survivals
Radium alone	Heyman, Sweden	1914–1931	21.6% 5 yr. absolute
Radium (and roentgen rays)	Heyman, Sweden	1932–1941	39.9% 5 yr. absolute
Radium, alone	Dresser, Mass.	1924–1928	25.0% 5 yr. absolute
Radium, 200 kv. roentgen rays	Dresser, Mass.	1934–1938	46.0% 5 yr. absolute
Radium alone	Hunt, free cases	1931–1936	20.5% 5 yr. absolute
Radium and roentgen rays	Hunt, free cases	1937–1941	42.1% 5 yr. absolute
Radium and roentgen rays	Hunt, private cases	1932–1944	66.7% 5 yr. absolute
800 kv. roentgen rays and radium	Schmitz	1948	43.4% 5 yr. relative
Transvaginal and external roentgen irradiation	Caulk	1949	35.0% 5 yr. absolute
Interstitial radium (and roentgen rays)	Waterman	1947	44.4% 5 yr. relative

B. Comparison of Irradiation and Surgical Survivals in Operable Stages

Methods	Author	Year	Stage	Survivals
Radium and roentgen rays	Martindale	1948	I, League of Nations	82.0% 5 yr.
			II, League of Nations	60.0% 5 yr.
Radium and roentgen rays	Miller	1948	I, Univ. of Mich.	89.0% 5 yr.
			II, Univ. of Mich.	57.0% 5 yr.
Radium and roentgen rays	Hunt (private)	1949	I and II, Schmitz	83.0% 5 yr.
			III, Schmitz	56.0% 5 yr.
Panhysterectomy and node resection	Meigs	1949	Selected early	77.0% 3 yr.
Radical panhysterectomy	Bonney	1941	Operable	41.0% 5 yr.
			All cases	25.0% 5 yr.

The development and selection of applicators for intracavitary irradiation from the vaginal vault has been given much consideration. The relative advantages of the Paris cork cylinders, the Manchester ovoids, and Stockholm boxes for irradiation of the vaginal vault have been reviewed and their isodose curves analyzed by

a very slightly better parametrial depth dose in about 10 per cent of vaults which measure over 7.5 cm. in diameter, but give a relative over-irradiation of the cervix and rectum in the smaller vaults. The flat box-type vaginal applicator gives the poorest parametrial depth dosage due to its short distance of delivery to the mucosa

and was used by us only in the treatment of lesions of the vaginal septa. The London type colpostat was found to be unsatisfactory because of the lack of control of location of the barrel through the screw-in handle. The expanding applicators of Ernst and of Campbell provide the advantages of reproducible geometry, more homogeneous irradiation of the cervix with even lateral extension across the vault. The disadvantages and limitations of such applicators are their relative inflexibility and the necessarily small colpostat barrels giving a relatively high mucosal as compared to parametrial depth dosage.

We have developed a colpostat which provides better control during placement, more flexibility in application and quicker handling.* The handle attaches to the aluminum barrel by means of a keyed ferrule, such as an Allen socket. Ferrules are placed in the side of the barrel and end of the cap, permitting insertion crosswise or lengthwise. The cap is quickly screwed into place by insertion of the handle into the cap, and since the relatively coarse threads used require only two turns for closure, this reduces time and exposure involved in loading and unloading. The handles are held snugly in the barrel by means of a long thread encircling the waist of the colpostat and held securely between

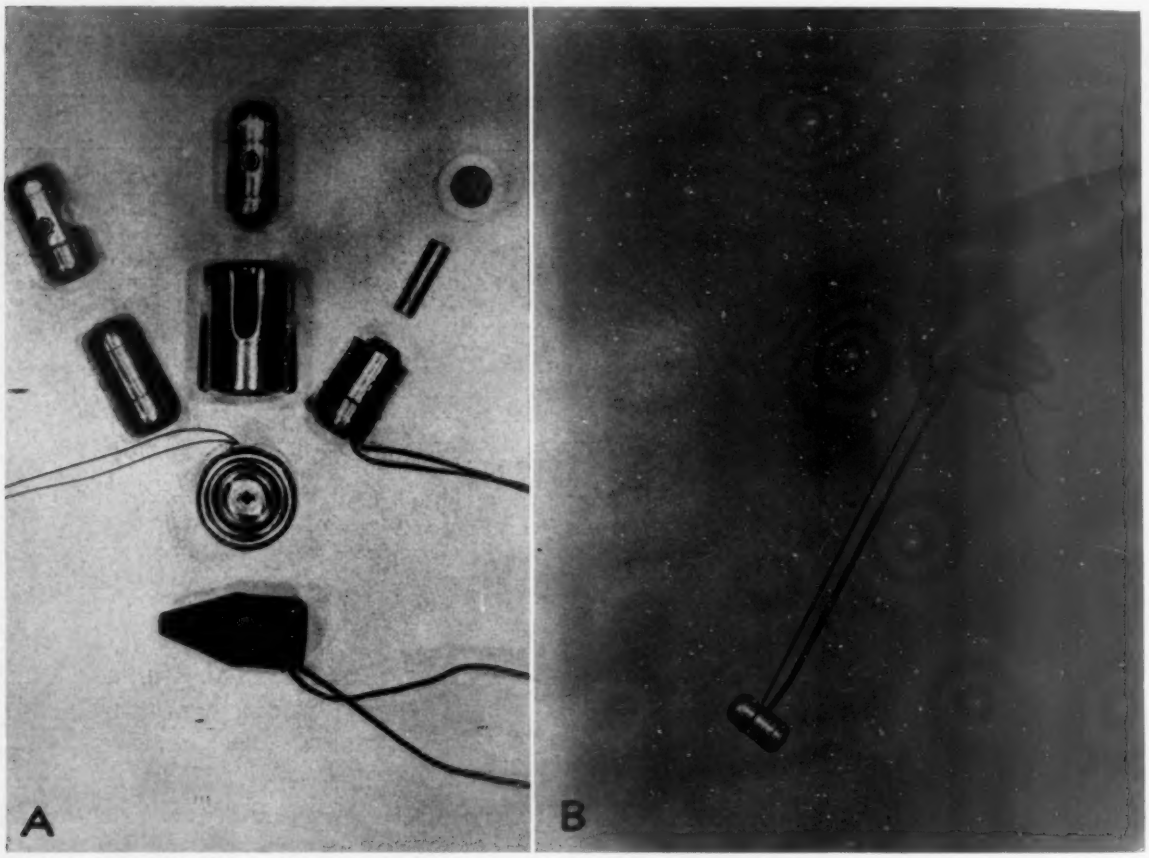


FIG. 5. (*A*) Cylindrical colpostats with sockets in barrel and end-cap providing quicker loading, better placement and more control. Note cylindrical spacer for centering single tubes and detachable sleeves for adding distance. (*B*) Anchoring of handle in colpostat by thread held along with handle between thumb and forefinger.

* Manufactured by the K.C. Engineering & Machine Co., Saginaw, Mich.

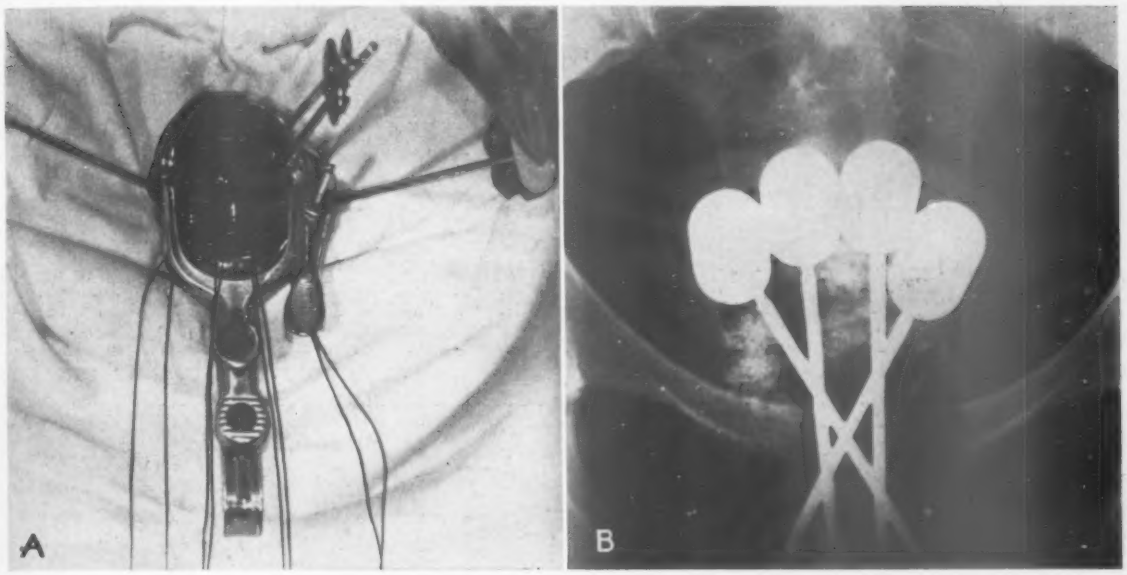


FIG. 6. (*A*) Usual arrangement of handles during placement and fixation of colpostats. (*B*) Roentgenogram showing placement of colpostats by handles and retention by zinc oxide gauze packing.

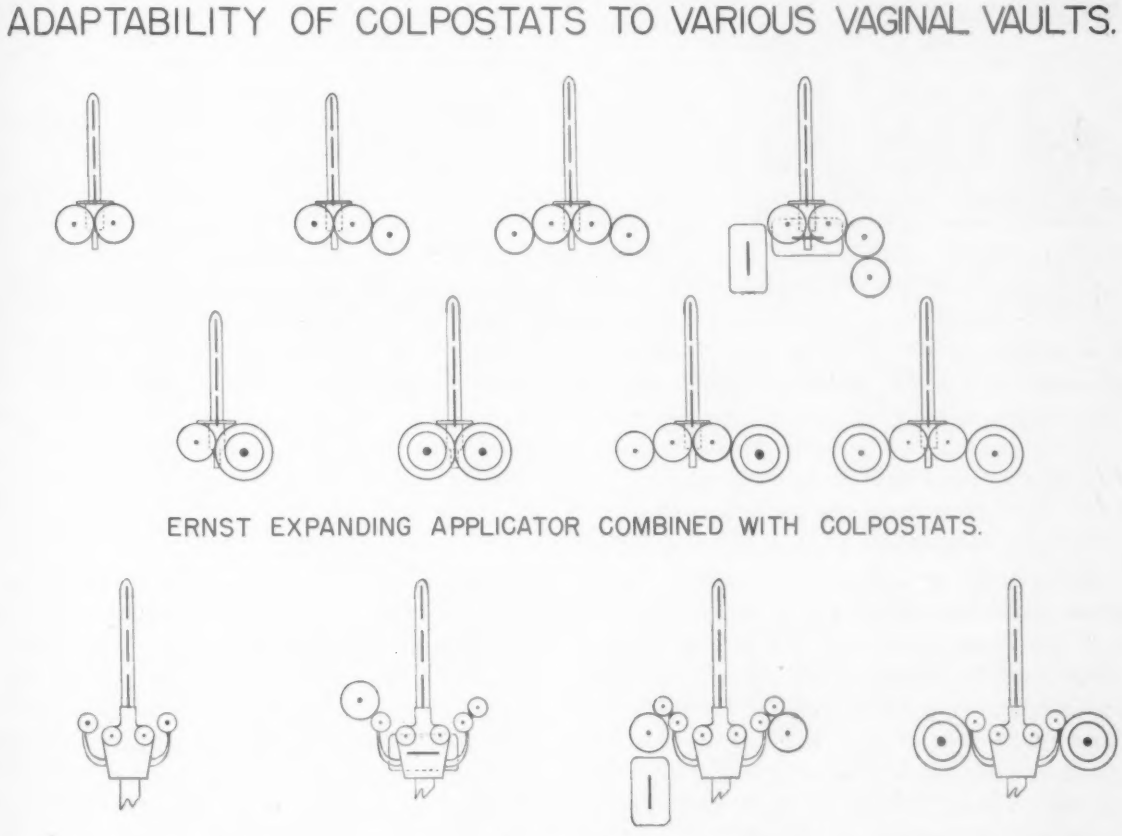


FIG. 7. Adaptation of colpostats to vaginal vaults of varying sizes and to differing distributions of disease.

the fingers and the end of the handle. The handle is 10 inches long and fitted with a metal flange which indicates the alignment of the barrel of the colpostat, even when obscured by vaginal packing. The handles are cocked forward at about 15 degrees, turning the colpostat away from the rectum and toward the face of the cervix. After the colpostat has been securely packed in place, the handles can be withdrawn without hazard of rotation. The colpostats measure 1.8 cm. in external asymmetrical involvement or extension along the vaginal wall, additional colpostats, even six or eight, can be packed into the vagina. The 1.8 cm. or even 2.4 cm. colpostats can be effectively combined with the Ernst applicator, being inserted lateral to or in place of the detachable lateral barrels. Considerably larger radium sources can thereby be placed in the lateral vaginal vaults for more effective delivery of radiation into the parametria without undue injury to the mucosa. Colpostats can be

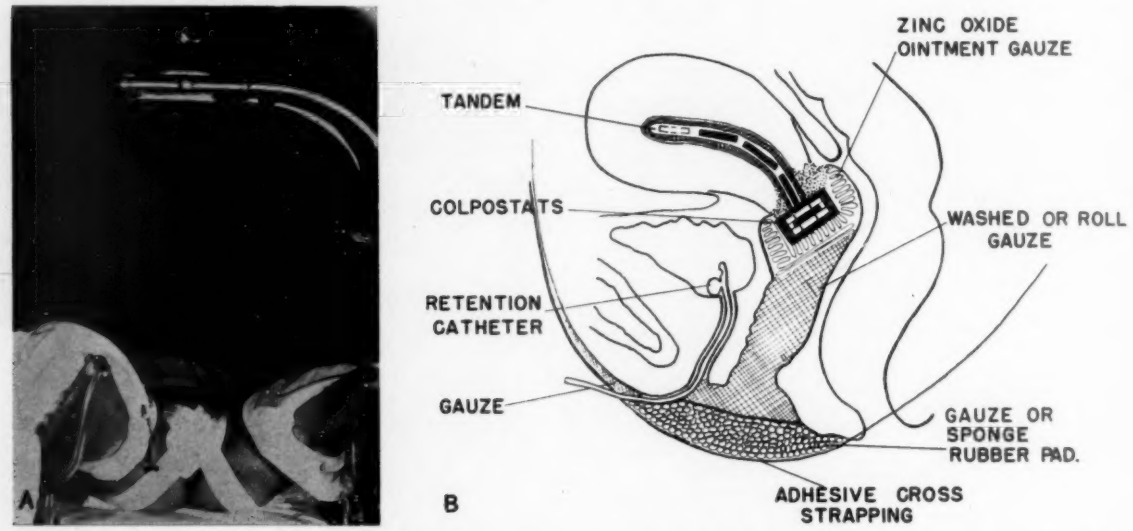


FIG. 8. (*A*) Diagram showing fixation of radium colpostats and tandem by zinc oxide ointment gauze packing in vagina. (*B*) Retention of packing by adhesive strapping across perineum, anus exposed, bladder drained by Foley catheter.

diameter and 3 cm. in length. Small vaults will accommodate two such applicators, and the average vault will admit four. The two central colpostats are grooved along adjacent surfaces which encircle the stem of the intrauterine tandem. The metal collar of the plastic stem or neck of the rubber sac fits securely in this groove and aids definitely by immobilization of the colpostats in relation to the cervix and central portion of the vault. The diameter of the colpostat can be increased from 1.8 cm. to 2.4 cm. by enclosure in an aluminum sleeve. Such large applicators are used only in vaults measuring over 7 cm. in width, or in about 10 per cent of cases. In case of thrust farther laterally by insertion from the opposite sides between the blades of the speculum, crossing the handles and prying outward. Additional colpostats may be effectively placed crosswise or lengthwise in the vagina for the treatment of disease beyond the range of the Ernst applicator and the usual parametrial colpostats.

Careful preliminary determination as to patency of the os, length and direction of the uterine canal, width of the vaginal vault and regional distribution of disease will render the subsequent application of radium more effective. Empty applicators may even be applied to avoid unnecessary exposure to loaded applicators which do

not fit the vault. The spaciousness of the vault can be effectively measured by means of a DeLee internal pelvimeter fitted with rounded flanges simulating colpostats as shown in Figure 10. Great variability in the spaciousness of vaginal vaults is observed, as reported by Moore and Tod.

We now implant low intensity radium needles interstitially in selected cases, but none of the cases reviewed at this time were so treated. Our *absolute* five year survival rate of 42.1 per cent in the University Clinic cases and the results of Lampe and Miller compare very favorably with the best *relative* five year survival rate of 44.4 per cent attained by Waterman with paracervical and parametrial implantation of radium needles (Table III, A). The dosimetric studies of Nolan and of Corscaden should be reviewed by anyone undertaking the treatment of carcinoma of the cervix and parametria by implantation. We now utilize interstitial radium, but only for supplementary dosage of 2,000 to 3,000 gamma roentgens to persisting parametrial masses and paravaginal extensions and for isolated mucosal metastases. We do not feel that the additional hazards of infection, hemorrhage, and high dose effect warrant its use except when specifically indicated as above.

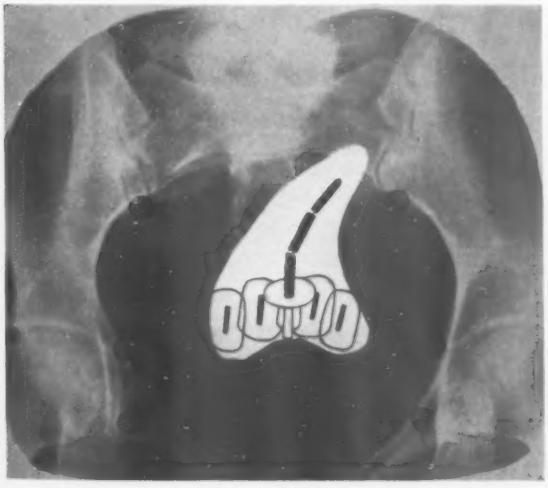


FIG. 9. Roentgenogram and diagram showing isodose shield superimposed over distribution of radium sources. Location of obturator, iliac, ureteral and hypogastric nodes indicated.

FIG. 10. Modified DeLee internal pelvimeter for measurement of vaginal vault in planning application of radium. Internal pelvic localizer for surface localization of cervix and vaginal vault as an aid in placement of isodose shield.

All radium therapy must be individualized to achieve maximum effectiveness. We have used no set dosage in terms of milligram hours and no fixed pattern of application. Radium sources must be placed according to the distribution of disease and dosage in terms of milligram hours varied widely according to the geometry and extent of radium placement and supplemental irradiation by roentgen rays, as well as according to tolerance of the patient. We have relied primarily upon radium for the treatment of carcinoma of the cervix uteri, as have Heyman, Martin, Bowing and many others, although moderately intensive roentgen therapy has also been used in practically all cases since 1937.

Transvaginal roentgen therapy was not used in any of the cases reported in this presentation, although we now use it in selected cases for the treatment of carcinoma of the cervical stump, isolated recurrences, for delivery of additional radiation to residual parametrial masses, and

occasionally supplemental to intrauterine radium in Stage I and II cases for reduction of hospitalization. The effectiveness of transvaginal therapy is limited to a marginated cone of radiation as contrasted with the spheroid irradiation from radium. Coverage increases with the size of the cone and the degrees of lateral angulation attainable. Irradiation of the parametria is most effective when delivered through a 3.0 to 4 cm. cone angulated 30 degrees laterally into each parametrium and is significantly restricted when only one centrally directed beam is used, according to Nolan. Transvaginal roentgen therapy reduces hospitalization, spares the radiotherapist exposure and centralizes responsibility in the roentgenologist, but reported five year survival rates have not surpassed 35 per cent (Caulk) (Table III, A).

External high voltage roentgen therapy has been utilized for increasing total irradiation of the parametria and of the obturator, iliac and hypogastric nodes along the lateral pelvic walls. It has been possible to deliver about 60 per cent of the dose (measured in air) 5 to 7 cm. lateral to the midline at a depth of 10 cm., using conventional 200 kilovolt radiation, filtered through 1 mm. Cu equivalent, delivered at a relatively long distance of 70 cm., and distributed through a fairly wide ovoid port of about 17 by 21 cm. with center isodose shield. Direct centering over each parametrium separately does not increase the depth dose by even 1 per cent and the use of two smaller 10 by 15 cm. portals reduces the depth dose at 10 cm. from 60 to 50 per cent. Anterior and posterior portals only have been used in Stage I and II cases and in patients under 22 cm. Parametrial dose has been effectively increased in Stage III and IV cases by addition of oblique, ischial and lateral beams directed to avoid the femoral neck. Isodose curves for various combinations of superimposed roentgen and radium therapy have, of course, been prepared by Arneson, Quimby, Nolan, and Mayneord, and charts for translation of milligram hours of radium of various geometries into gamma roentgens by Paterson, Parker, Meredith, and Quimby.

We now endeavor to individually protect the central zone irradiated by radium against further excessive radiation from roentgen rays. A lead shield is fashioned according to the isodose curve of the radium sources as distributed across the vaginal vault and along the uterine canal. The dose side scattered 10 cm. beneath such a shield is 30 to 40 per cent of the air dose or one-half to two-thirds the lateral parametrial dose according to our presdwood phantom measurements. We believe that such an individually patterned, usually pear-shaped shield, when properly located on the skin in the path of the roentgen rays, offers advantages over the conventional midline lead strip. The heavily irradiated lateral vault zone and the too often deviated uterine canal are better shielded, also the upper mid vaginal tract, a not uncommon site for recurrence, receives needed additional radiation. The location and distribution of radium sources is determinable from the roentgenograms made at the time of their application. In addition, the level and width of the vaginal vault can be superimposed on the abdominal wall by means of an internal pelvic localizer, as devised by Sandler. Our localizer consists merely of a General Electric roentgenographic caliper equipped with two spirit levels, as shown in Figure 10. We appreciate the inadequacies and approximation of this shielding, but believe it to be adaptable to the wide portals necessitated for good depth delivery of 200 kilovolt radiation. Sandler, Mayneord, and Lederman, and Winternitz at the Royal Cancer Hospital in London use geometrically directed smaller, 5 by 14 cm., beams of higher voltage radiation through abdominal, sacral, gluteal and at times lateral portals. No anterior or posterior beams are directed through the central 5 cm. of the pelvis to avoid over-irradiation of the zones of radium therapy. The re-

quirements of geometrical accuracy for exact direction of these relatively small supervoltage beams has led Sandler to devise various accessories, such as the internal pelvic localizer, the pelvic measuring bridge, the inclinometer and the pelvic tripod. All radiotherapists should familiarize themselves with the outstanding studies of dosimetry, application of radium sources and integration of radium and roentgen therapy now under way in the Manchester and London radiotherapeutic centers.

The proponents of supervoltage therapy are inclined to attribute their improving results entirely to use of this modality rather than to any other contributing factors. Schmitz, in 1948, reported a five year survival rate of 43.47 per cent which does not surpass our absolute five year survival rate of 46 per cent for all cases treated at the University Free Clinic and in private practice from 1937 through 1944, using conventional 200 kilovolt radiation and fractionated radium therapy. We are not denying the theoretical advantages of supervoltage therapy, but emphasize that there are many other contributing factors worthy of study and improvement (Table III, A).

CONSIDERATION OF COMPLICATIONS

The serious significance of high dose effects has been emphasized by Tod, Lenz, Waterman and others. Tod established that the five year survival rate decreased and the incidence of high dose complications increased markedly as the dosage to point A in the paracervical triangle was carried above 9,500 gamma roentgens during three to four weeks. These ill effects consisted of paracervical and pararectal ulceration and death from uremia attributed to ureteral stricture. We must realize that cure rates are not increased merely by giving more milligram hours or more roentgens, but through relatively more homogeneous irradiation at a level of 7,000 to 8,000 roentgens throughout the pelvis. We must learn to think of radium dosage in terms of gamma roentgens delivered to various pelvic zones and roentgen therapy in terms of roentgens delivered to those zones as well as to the outlying lymph nodes and metastases. Total dosage must be related to total period of administration for predication of biological effect.

Susceptibility to post-irradiation necrosis is increased by preceding infection, an infiltrating type of cancer and an arterial supply composed of vessels of smaller than average caliber. Control of pelvic infection early in the course of radiotherapy will reduce complications and increase cures. The five year survival rate is reduced to one-half in cases complicated by pelvic infection. Heyman advises removal of abscessed tubes prior to intensive irradiation. Infection can be reduced by cleansing douches, elimination of necrotic masses preliminary low dosage roentgen therapy, bacteriostatic and antibiotic drugs, and the avoidance of unnecessary trauma during biopsy and application of radium.

Susceptibility of individual patients to ureteral stricture varies with their scar tissue production as related to infection and pre-existing cancer, and also to the caliber of the ureters themselves. Such obstruction is demonstrable by excretory urograms and warrants attempted ureteral probing and dilatation. If the pelvis seems clear from cancer, transplantation of a ureter to the colon seems warranted, particularly if there is threatened obstruction of the opposite ureter.

In elderly and frail patients, one must proceed cautiously with adjustment of dosage to the patient's reserve. Radiation sickness, post-irradiation enteritis or pelvic infection may precipitate abdominal distention, shock, hypotension and cardiac failure in these debilitated patients. Such complications may terminate fatally unless promptly recognized and properly treated. Encouragement of patients to move about in bed while packed with radium will reduce the incidence of pulmonary embolism.

RELATIVE STATUS OF SURGERY AND RADIOTHERAPY

Proponents of the revival of surgical treatment of carcinoma of the cervix uteri have presented radiotherapeutic statistics which seemingly contradict our thesis and optimism. Meigs in 1944 submitted a tabulation of results from outstanding radiation centers showing five year survivals of only 26.3 per cent. Munnell and Brunschwig in 1948, reporting from the Memorial Hospital in New York, found an over-all five year cure rate of only 28.6 per cent from 1934 through 1941, also a lack of progressive improvement in results during that time. Meigs and Brunschwig have put forward these figures as an indication that radiotherapy in carcinoma of the cervix had already passed its zenith of effectiveness and promised little or no further improvement. It is evident that the radiotherapeutic results quoted by them of 28.6 per cent and 26.3 per cent five year survivals are not representative of results achieved even five years ago, since the representative figure had risen to about 40 per cent, as pointed out by Richards, and now promises to yield an average well above 40 per cent, as shown in Table III.

Meigs reports a three year surgical survival rate of 77 per cent for early selected cases, which does not surpass the radiotherapeutic results reported by Miller, Stage I, 89 per cent and Stage II, 57 per cent five year survival, nor those of Martindale, League of Nations Stage I, 82 per cent and Stage II, 60 per cent five year survival, nor that indicated by our *absolute* five year survivals as presented in Table I, column 4, Schmitz Stage I and II, 83 per cent, Stage III, 56 per cent five year survivals (see Table III, B).

If surgery is to regain a significant place in the treatment of cancer of the cervix uteri, it will come, not so much because of default by radiotherapy, but rather through surgical progress. Advances in surgical technique, such as the retroperitoneal dissection of lymph nodes with radical hysterectomy as developed by Meigs and Nathanson for Stage I and II carcinomas might possibly yield more ten and twenty year survivals in young women, but appears no better now at the five year stage (Laborde). The recent revival of hysterectomy in outlying regions is now bringing too many hysterectomized cases to the radiotherapist with advanced metastases to the obturator and iliac nodes, obstructed ureters and vaginal recurrences. The radical total pelvic viscerectomy conducted by Brunschwig for Stage IV lesions has been made possible by better conservation and support of the patient's physiological reserve to withstand the severe shock of this bold procedure. Superior surgery may possibly come to have a place in removal of the uterus for carcinoma of the cervix in situ, post-irradiation hysterectomy in selected young women and in Stage IV cases locally invading bladder and rectum. The results of radiotherapy, as well as those of surgery, may be expected to improve with more meticulous attention to technical details, better control of infection, better clinical evaluation and conservation of individual physiological reserve, and the formulation of treatment specific for the individual's anatomy and particular distribution of disease.

We are indebted to Dr. Robert M. Coleman for valuable assistance in case analysis, to Dr. Walter Giles and Mr. Stanley Kerkhoff for follow-up case studies and statistical analyses, and to Mr. George Pfau and Miss Alice Meredith for assistance in preparation of the paper and scientific exhibit. This review has been assisted by a grant from the National Cancer Institute, United States Public Health Service.

SUMMARY

1. Response of consecutive unselected cases of carcinoma of the cervix uteri to radiotherapy has shown improvement in *absolute* five year survival rates at the University of Nebraska Hospital from 20.5 per cent for 1931–1936 up to 42.1 per cent for 1937–1941.

2. A transient decline in five year survival rates during 1942–1944 was not representative, being attributed to poorer case material and insufficient supervision related

to war time conditions, as shown by a subsequent rise of three year survival rate to 64 per cent.

3. An *absolute* five year survival rate of 66.7 per cent in the private practice group is attributed to favorable case material and effective integration of radium and roentgen therapy.

4. Variability of case material between free clinic and private practice and its modification by economic and educational factors renders five year survival rates an unreliable index of the comparable efficacy of therapy alone.

5. The concurrent or alternating consecutive administration of radium and roentgen therapy builds up a more effective biological dosage in the parametria than when roentgen and radium therapy are separated by an interval of days.

6. Fractionated application of radium permits more effective distribution of dosage, greater individualization, and fewer complications.

7. Irradiation of the parametria by radium is most effective when applied early, prior to shrinkage of the vaginal vault, to permit placement as far laterally as possible, although spaced at a distance of 8 mm. or more from the vaginal mucosa.

8. Radium placement should be checked immediately by anteroposterior and lateral roentgenograms for determination of the distribution of intensities, calculation of dosage in gamma roentgens, and used for reference in the planning of subsequent applications and explanation of recurrences or complications.

9. A modified vaginal colpostat is described which provides better control in its placement, greater adaptability in application, variability in size, more security in immobilization, more anatomical positioning and quicker loading.

10. A plan is proposed for individualized protection of the zone intensively irradiated by radium against excessive roentgen therapy by means of individually patterned isodose shields and their proper superimposition on the abdominal wall.

11. A simple internal pelvimeter and internal pelvic localizer is described.

12. The danger of high dose effects with the possible lowering of five year survival rates and the need for gauging dosage according to individual tolerance is recalled.

13. Present day radiation therapy for cancer of the cervix uteri compares favorably with the best results achieved by radical hysterectomy.

14. Continued progress in radiotherapy requires closer attention to all details of application of radium and roentgen rays with greater individualization according to the distribution of disease and tolerance of the patient.

15. Finally, the selection, modification and integration of radium and roentgen therapy is most satisfactorily achieved when complete responsibility for both procedures is accepted by the radiotherapist.

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DISCUSSION

DR. RALPH M. CAULK, Washington, D. C. My discussion of Dr. Hunt's excellent paper must necessarily be confined to material available in the manuscript which he presented to me only a few days ago. My copy of the manuscript did not contain the detailed charts and illustrations that were presented this afternoon.

A statistical analysis of this type represents a vast amount of hard and tiresome work. I know this because I have recently completed a similar review of my own material.

The cure rate and survival data presented are comparable to the results found in the very best clinics today, and superior to that found in most available published material. Dr. Hunt has been able to combine radium and roentgen therapy

into an excellent treatment schema. The excellent results are a just reward for his endeavors. Many radium therapists would not agree with his choice of vaginal applicators. On this, I have no convictions. It seems to me that almost all radium therapists have their own particular choice of vaginal applicators and were all these exploited to their fullest advantage, the choice would be merely a matter of individual taste rather than the inherent qualifications of the applicator itself.

My criticism of Dr. Hunt's paper is directed not to the quality or character of his work, but rather to the manner in which he has presented his material. Statistical analyses of this type are of the greatest benefit to those interested in comparing treatment results of the various clinics. All radiotherapists should be sufficiently critical of their work to subject it to comparison with the material and results obtained elsewhere. I think that the author of every paper of this type should expressly account for every case that came under his purview during the time in which his material was treated. This should be *emphasized* in order that the reader can be assured that the problem of selection did not enter into the presentation. Selection is perfectly proper, providing the basis for selection is clearly apparent. I would even go so far as to say that consultation, even by telephone, in which cases were rejected for treatment for various reasons, should be incorporated into the statistical analysis. It becomes quite apparent that if advanced bases are rejected for one reason or another, the statistical analysis becomes prejudiced.

Dr. Hunt's manuscript did not show the number of cases in any stage that he treated. That is important to us because, while we have the over-all survival in absolute figures, if I were to compare my work with Dr. Hunt's, I would like to be assured that at least the material accepted for treatment was in some way comparable.

I recognize the difficulties encountered in various examiners classifying cancer of the cervix by stages, but any step in that direction is an index as to whether or not comparable material is being evaluated. There is one point regarding classification that should be clarified. None of the accepted *clinical* classifications take cognizance of the group of cases which I refer to as the *modified group*. This would include cases with incomplete surgery, postoperative recurrences, and cases treated by radiation therapy elsewhere, with the disease uncontrolled. The survival rate in material of this type is so poor because of the biological modification, rather than anatomical extent of the disease, that the treatment results are in no way comparable to those obtained in previously untreated cases.

Dr. William Harris, New York, N. Y. I should like to ask Dr. Hunt several questions. Does Dr. Hunt believe that he can destroy involved lymph nodes from carcinoma of the cervix by external irradiation? There are numerous instances where extensive pelvic disease connected with carcinoma of the cervix may be, at times, cured but this may not include involved pelvic lymph nodes but rather parametrial spread by contiguous growth.

I should like to also ask Dr. Hunt how he gets 6,000 r into the lateral pelvic wall if 200 kv. is used to supplement the radium treatment. From the literature, it would seem that many complications such as fractures of bone and damage to the bladder and rectum have been reported when dosages of such magnitude have been employed.

Dr. Hunt (closing). First, I wish to thank the discussants, Dr. Caulk and Dr. Harris, for their remarks, criticisms and questions. In reply to Dr. Caulk's criticism as to the need for further breakdown of the case material, it would seem that this has already been covered by the graphic charts shown in the first threes slides. In Graph 1, the University of Nebraska case material is there presented case by case, year by year, broken down as to Stage I, II, III, IV, with accurate recording of the cases known to be living after three years and five years. Graph 2 shows the five year survival rate for the various University Clinic groups and for the private case group according to Stages I, II, III, and IV. In keeping with Dr. Caulk's suggestion, these data will be presented in tabular form in the published paper.

Now, in answer to Dr. Harris' inquiry as to the selection of cases: I wish to emphasize that the case material represents all consecutive unselected cases of carcinoma of the cervix as encountered in clinic and in private practice. Whatever selection occurred was extraneous, being based on eligibility for admission as a free patient at the University of Nebraska Hospital and based on the confidence and request of referring physicians in private prac-

tice. As pointed out in the paper, the case material of any series is bound to be modified by extraneous factors, free clinic cases being generally more advanced and unfavorable. In private practice, case material tends to deteriorate as the reputation of the therapist increases due to referral of more advanced cases and more cases modified by previous surgery or ineffective radiotherapy. The intercomparison of even absolute five year survivals, therefore, reflects this extraneous selection of case material as well as the efficacy of therapy.

Dr. Harris asks how we are able to deliver 6,000 roentgens by 200 kv. radiation to the periphery of the pelvis without injuring the bowel. I only stated that we would like to deliver 6,000 roentgens. Frankly, the dosage tolerated to date has been limited by the associated enteritis, as inferred by Dr. Harris, and not by the skin reaction which leads us to question the claimed superiority of higher voltage radiation. In the average case we have delivered 2,000 to 2,500 gamma roentgens by radium and 2,000 to 3,000 roentgens by x-rays. We hope to raise the tolerable roentgen dosage by more individual shielding of the area heavily irradiated by radium. The delivery of radiation into the lateral pelvis concurrently by roentgen rays and fractionated radium during a total period of three to four weeks has considerably more biological effectiveness than when delivered separately and over a period of six to eight weeks. The depth delivery of 200 kv. roentgen rays has now been increased by using large, 16 by 21 cm., portals, a distance of 70 cm. or more, and a half-value layer of 2 mm. of copper. The relative radiation delivered to the pelvic nodes by radium is increased through its early placement in the lateral fornices and along the walls of the vagina in large copostats and by placement of needles interstitially in the lateral parametrial regions when masses are persistently palpable there. In some cases the vaginal vault becomes so drawn to the side of major involvement as to bring the vaginal radium within 1 to 2 cm. of the pelvic wall and so within cancerocidal range.

It is impossible to accurately state to what extent it is possible to control cancer in peripheral pelvic lymph nodes by irradiation. Certainly we have many five year survivals among patients who seemingly had hopelessly advanced, incurable disease. Of course, it has been impossible to establish histopathologically the incidence of metastases to pelvic nodes in our cases cured by radiotherapy, although some of our five year survivals undoubtedly had such involvement. The obturator and lower iliac nodes, being within the range of higher radium dosage and more isolated from the intestines than the more remote upper iliac and hypogastric nodes, are more definitely amenable to control by combined radium and roentgen therapy.

Finally, we wish to emphasize that, in our opinion, 200 kv. radiation and the facilities for radium therapy which are now available can be much more effectively utilized and combined for the treatment of carcinoma of the cervix. We have no complacency with our present methods of therapy and attribute our improving results in this series of 323 cases to good fortune as well as to individualization in treatment.

CALCIFIED METASTATIC DEPOSITS IN THE PERITONEAL CAVITY, LIVER AND RIGHT LUNG FIELD FROM PAPILLARY CYST-ADENOCARCINOMA OF THE OVARY

By LOUIS NATHANSON, M.D.
BROOKLYN, NEW YORK

THE following case report is placed on record because of the unusual and extensive calcification and possibly ossification occurring in a proved case of papillary cyst adenocarcinoma of the ovary with metastases. The calcification was present in dense irregular plaques throughout the abdomen. The liver was almost completely demarcated with large dense calcific masses and irregular nodular deposits were present within the right lung field. Although the extent of calcification is unusual in this patient, it is because of the demonstration of the liver and lung metastases that this case is being presented.

CASE REPORT

The case history, surgical findings, and pathological report as given by Dr. Jerome J. Weiner, are as follows:

Mrs. C. B., white female aged twenty-three, presented herself at my office on January 4, 1946, complaining of pain in the abdomen of several days' duration. The pains were cramplike in nature and radiated over the entire abdomen. The cramps subsided with the onset of menstruation. Her appetite was poor and she had lost some weight. There was no history of nausea or vomiting.

In 1943 she had had an appendectomy and removal of the right ovary at the Brooklyn Jewish Hospital.

Pelvic examination revealed a mass about the size of a grapefruit which extended up to the umbilicus. The mass was hard, firm, irregular and appeared to be intimately connected with the body of the uterus. A tentative diagnosis of fibroid uterus was made and surgery was advised.

She was admitted to Manhattan General Hospital on January 9, 1946. When the abdomen was entered the entire pelvis was found invaded with multiple cysts involving the uterus and left ovary. There was a large subperitoneal pedunculated fibroid which was attached to the fundus of the uterus and which was invaded with multiple cysts. Three solid masses the size of golf balls were attached to the site of the appendiceal scar. The omentum

FIG. 1. Irregular calcified deposits distributed throughout pelvic and abdominal cavities. Entire liver studded with calcified deposits. Liver margin outlined by calcification.

was wrapped around these masses. The parietal peritoneum was studded with numerous metastatic nodules. The entire contents of the pelvis were cleaned out and the three masses attached to the parietal peritoneum and part of the omentum were excised.

FIG. 2. Lateral view of the abdomen, showing anteroposterior extent of calcification.

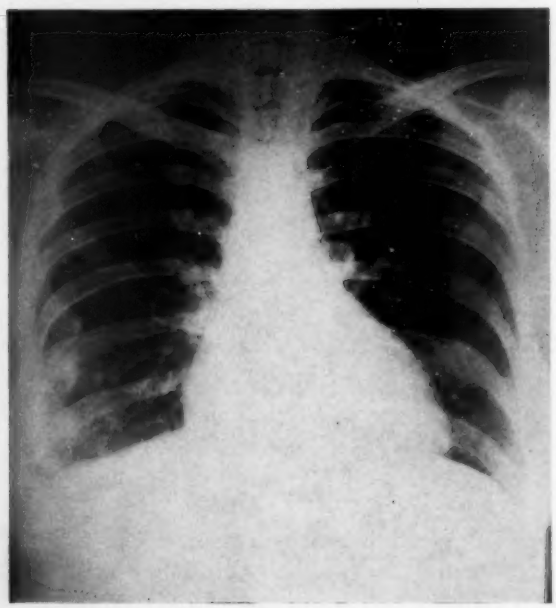

FIG. 3. December 16, 1946. Irregular nodular calcified deposits involving the inferior lateral margin of the right thorax.

The pathological report reads as follows: The specimen consists of a large amount of tissue and several fragments. One mass is 13 by 7 by 6 cm. It is partly solid and partly a cystic tumor of variegated appearance, with areas of necrosis and hemorrhage. Another mass is the size of a small orange and is a soft hemorrhagic tumor of the consistency of fish flesh. Another mass shows a small uterus 4 by 3 by 4 cm. to

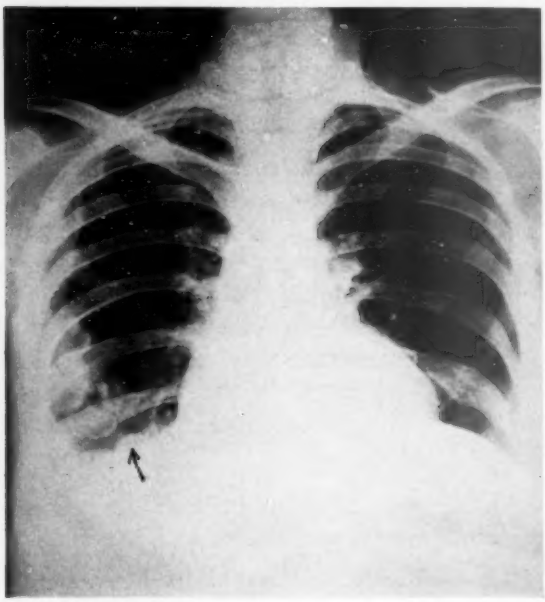

FIG. 4. February 6, 1947. Increase in extent of calcification and an additional nodule above the right cusp of diaphragm. The additional deposits developed while patient was receiving postoperative radiation therapy.

which is attached what appears to be the wall of an ovarian cystic tumor which has been opened. The wall has an average thickness of 1.5 cm. and appears to be neoplastic. There are in addition several masses of hemorrhagic tumor tissue. A microscopic diagnosis of papillary cystadenocarcinoma of the ovary Grade 2 characterized by the presence of numerous psammoma bodies was made.

The patient was discharged on January 19, 1946, and was referred for postoperative care and roentgen therapy.

The patient received a total of 2,400 roentgens (measured in air), using 1 mm. of copper filtration, to each of six portals through fields measuring 15 by 20 cm. in size. In this way the anterior and posterior pelvic and lumbar portals were irradiated over a period of eight

weeks. During this interval the patient's general condition improved and she gained 21 pounds in weight. The calcified deposits increased in number and extent in the peritoneal cavity and additional nodules developed within the right thorax. Her general condition remained satisfactory for approximately two years, following which she rapidly developed peritoneal effusion, lost weight and died. The patient's abdomen from the time the treatment was started was distended, boardlike and under tension. Many hard solid masses were palpated throughout the abdomen and pelvis and the liver was enlarged and irregular.

Roentgen examination of the abdomen revealed many irregular solid calcified or ossified deposits of varying densities and configurations. Some of the deposits were of a psammoma type, others were nodular and plaquelike in configuration. The masses were distributed irregularly throughout the peritoneal cavity and the liver was outlined by numerous irregular deposits of varying sizes, and an irregular rim of calcification outlined the margin of the liver. Several dense calcified nodular deposits were present within the lateral inferior portion of the right thorax and an additional deposit developed immediately above the diaphragm while the patient was under treatment. The individual deposits did not change in configuration or consistency to indicate increase or decrease in size of the metastatic lesions.

SUMMARY

A case is presented of diffuse widespread calcification of a psammomatous, nodular and plaquelike nature in a patient with papillary cyst adenocarcinoma with metastases. Psammoma bodies were present in the primary lesion. The case is unusual in that the calcified metastatic deposits were visualized in the liver and right lung field. To my knowledge these latter findings have not been previously reported.

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NEUROFIBROSARCOMA OF THE NECK

REPORT OF CASE WITH TEN YEAR SURVIVAL AFTER ROENTGEN THERAPY

By HIRSCH MARKS, M.D.

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DEFINITION AND CLASSIFICATION

NEUROFIBROMAS are fibrous tumors of the nerve trunks and filaments. They are divided into two main forms:

1. Cutaneous neurofibromas:
   (a) single (tubercula dolorosa)
   (b) multiple (von Recklinghausen's disease)
2. Neurofibromas of the subcutaneous and deeper nerve trunks:
   (a) plexiform neurofibromas
   (b) visceral neurofibromas
   (c) neurofibrosarcomas

HISTOPATHOLOGY

Neurofibromas do not represent a uniform cellular structure. They are either chiefly fibromas, as in the case of the small dermal tumors, or they have all the elements of the nerve trunks and filaments represented in the tumor process.

CLINICAL COURSE

The clinical course is favorable in the case of a single nodule where excision without recurrence is the rule. It is less favorable in multiple neurofibromas of the von Recklinghausen type where an 8 per cent mortality is reported due to an extension of the tumors. As for the clinical course of the deeper neurofibromas, their serious nature, according to Ewing, is very imperfectly realized and, to quote from Ewing, "Little aid in their control can at present be expected from the ordinary methods of employing X-ray or radium as an adjuvant to surgery. Probably the best method of treatment is to apply radium or X-rays to the limit of skin tolerance. The persistent use of the X-ray may effect a cure."

CASE REPORT

The patient, F. F. (No. 17997), a colored female, aged thirty-eight, born in the United States, was admitted to the Cancer Hospital on February 17, 1939, complaining of a swelling in the right side of the neck. Her illness began six months prior to her admission, when a small nodule which she had had since her birth, began to grow rapidly. There was nothing in the past history relevant to the present condition.

Examination on the day of admission, February 17, 1939, revealed a huge mass, 11 by 9 by 10 cm., in right side of the neck, adherent to the underlying structure and extending from the mastoid region to the supraclavicular fossa. Biopsy specimen from the tumor of the neck was reported to be a perineural fibrosarcoma.

Other positive findings resulting from the pressure exerted by the tumor on surrounding tissues were: (1) excessive unilateral perspiration on affected side of face; (2) pain in right side of head; (3) Horner's syndrome; (4) increased prominence of veins in right upper extremity; (5) numbness in right upper extremity; and (6) difficulty in protruding tongue.

Roentgen examination of the neck revealed marked displacement of the hyoid, thyroid, larnyx and trachea by soft tissue tumefaction.

Roentgen therapy was instituted on February 27, 1939, and was continued with interruptions up to June 21, 1939. First interruption from March 7 to April 16 (forty-one days); second interruption from April 26 to 30 (five days); third interruption from May 9 to 14 (six days). The first respite was necessitated by an operation, tracheotomy, performed on March 6, 1939. The second and third were dictated by clinical considerations. The dosage was 390 roentgens, with backscatter, daily through two portals of entry. The total dosage was 10,400 r; tumor dose 6,720 r. The following factors were used: 200 kv., 10 by 15 cm. fields, composite filter, 50 cm. target-skin distance. Half-value layer equal to 1.8 mm. of copper.

The second course of treatments was instituted three months later because a residual tumor mass was still present, 3,900 r, with backscatter, was delivered through two portals of entry between October 24, 1939, and February 21, 1940, with intervals of respite from the

Fig. 1. Photograph of patient before roentgen therapy was instituted.

Fig. 2. Photograph of patient three months after completion of treatments.

Fig. 3. Photograph of patient eight years after completion of treatments.

Fig. 4. Photograph of patient taken January 23, 1950.

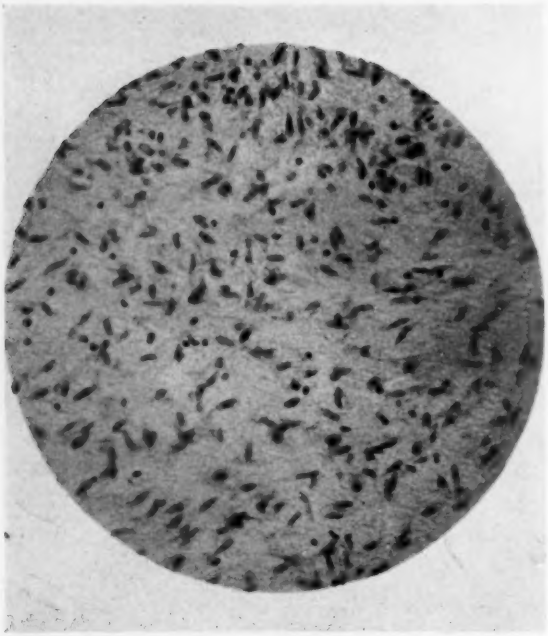

FIG. 5. Histopathology is that of a spindle cell sarcoma of perineural origin. High power magnification (×125).

treatment of three, five, and twenty-five days, respectively, dictated by clinical considerations. The tumor dose was 3,752 r.

Follow-up Examinations. On May 7, 1947, there was no evidence of recurrence. On February 20, 1948, there was no persistence of disease. On January 10, 1950, there was no persistence of disease.

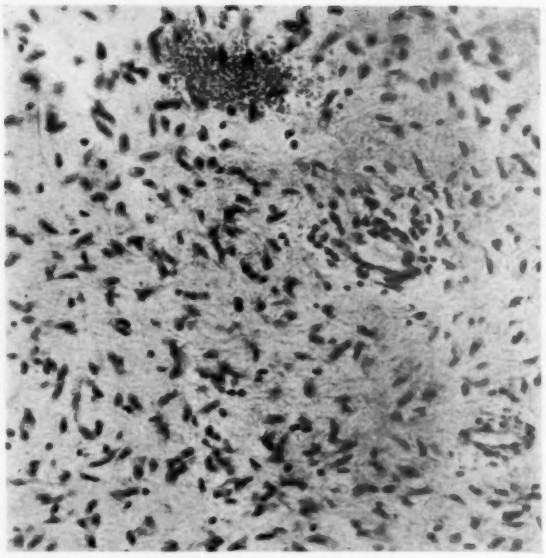

FIG. 6. Histopathology is that of a spindle cell sarcoma of perineural origin. High power magnification (×300).

CONCLUSION

The persistent use of roentgen therapy applied as a *clinical method* effected a complete cure in this case of neurofibrosarcoma.

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LARGE HYDATID CYST OF THE LIVER

CASE REPORT

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THE comparative rarity of hydatid cyst in this country, the mild symptoms, and apparent good health of the patient, would seem to make a report of this case interesting. The definite signs as seen in the roentgenogram would seem to make the diagnosis certain.

Small single or multiple cysts often occur in the liver, usually on the surface. Multiple cysts are often associated with a polycystic condition of the kidneys. The etiology of liver cysts is, however, obscure.

Clinically they are difficult to diagnose because of their small size. Large cysts may form with fluid contents of several pints; these are not usually so difficult to diagnose.

Echinococcus Cysts—Large cystic masses may occur usually in the right lobe of the liver. They represent the cystic or larval stage of an infestation by *Taenia echinococcus*. The ova of this parasite are ingested in drinking water or vegetables contaminated by excreta containing the ova. Cattle, dogs, sheep may carry ova to human beings. The embryo lodges in the intestinal tract, is passed to the portal vein of the liver, where it becomes encysted; it may gradually become larger forming calcified laminated layers, which enclose an inner liquefied mass containing hooklets and daughter cysts.

The symptoms caused by these cysts are usually pain and pressure from the mass compressing the liver, and a perihepatitis is produced. Colic may result from pressure on bile ducts; vomiting and constipation may be associated symptoms. The physical signs are those of an enlarged right lobe

FIG. 1. Posteroanterior view of the right upper quadrant showing large calcified cyst.

FIG. 2. Lateral view of the right upper quadrant shows a large calcified mass to lie posteriorly. The gallbladder filled with the opaque dye is also shown in this view.

of the liver associated with a fluctuant mass.

Complications may consist of rupture of the cyst into the thorax with cough, dyspnea and the presence of hooklets and fragments of the laminated membrane in the sputum. Rupture may occur into the bile ducts with chills, fever, and jaundice. Rupture may also occur into the peritoneal cavity, sometimes with considerable shock.

The diagnosis may be made from symptoms of perforation, invasion of the lungs suggested by respiratory symptoms and that of the peritoneum by shock. The roentgenogram is often of definite value in arriving at a diagnosis. Complement fixation or skin tests are also said to be of aid in the diagnosis.

The treatment is surgical but it may be attended with grave dangers, and result in death. The most common surgical procedure is incision and drainage of the mass contents.

CASE REPORT

The patient, Mrs. E. B., was referred by Dr. R. L. White of New Canaan, Connecticut, for symptoms referable to the liver and gallbladder. The patient, aged sixty-nine, had lived in Austria Hungary on a farm near Rumania, had dogs, cattle, sheep, and raised vegetables.

The patient came to the United States at the age of nineteen. She appeared well nourished, complained of indigestion after eating, associated at times with vomiting, but at no time had evidence of jaundice. She has borne six children; all her pregnancies were uncomplicated. Her present symptoms have persisted for some years. All physical signs and symptoms pointed to gallbladder disease, otherwise she has always been fairly well; previous history does not elicit any special illness or operation.

Cholecystographic examination showed filling and emptying of the gallbladder in about the normal time. Above the gallbladder pressing on it was shown an enormous large calcified cystic mass as large as an ostrich egg, in the liver region and posterior to it in the region of the dorsal and lumbar spine.

Studies of the gastrointestinal tract revealed no abnormality.

The patient would not submit to operation, but a diagnosis of a large hydatid cyst was made from the roentgenological studies. The patient at this time is in good health.

Frost Building
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A CALIBRATED ROENTGEN-RAY FILM BADGE DOSIMETER*

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INTRODUCTION

THE wavelength or energy dependence of photographic film sensitivity in the roentgen-ray region below 300 kv. has restricted the development of a quantitative roentgen-ray film badge dosimeter. An intelligent interpretation of radiation dose received in this region is possible only if the effective energy of the roentgen rays responsible for film blackening can be determined. This effective energy may be scattered as well as direct radiation.

Present film monitoring devices range from a paper clip attached to a dental film to a metal echelon type of badge covering the film.[4] The first system generally assumes that an excessive amount of radiation has been received whenever the outline of the paper clip is clearly visible on the processed films. In reality, the paper clip dosimeter does no more than indicate that some radiation dose has been received. Use of a metal echelon dosimeter makes it possible to approximate the effective energy of any radiation present by observing the varying degree of film density under the different metal shields. Control films utilizing the same type of metal marker are exposed to known radiation intensities at a voltage used during normal operation and are then used to check the radiation received. If operating techniques are such that all exposures are made within a restricted voltage range, the dosimeter will give a good indication of radiation incident on the film badge.

The quality or effective energy of a roentgen-ray beam is determined either by the half-value layer absorption method or by the direct determination of effective wavelength; both measurements normally are made with an ionization chamber. The half-value layer method involves plotting an absorption curve using increasing thicknesses of aluminum or copper and observing the thickness of metal required to reduce the original intensity to one-half its initial value. Glasser and Rovner[3] have compared half-value layer measurements using film techniques with ion chamber readings, and found them to be inconsistent with each other. The spectral sensitivity of film in this region causes the half-value layer measurements observed with film to be markedly different from ion chamber measurements.

Direct determination of the effective wavelength of roentgen rays involves but two measurements. First, the intensity of the beam in question is measured. A given thickness of metal absorber, usually aluminum or copper, is then placed between the beam and the ionization chamber and the intensity is again measured. From the percentage of beam absorbed by the metal, one can calculate the wavelength of a monochromatic roentgen-ray beam which will suffer the same amount of absorption. This is defined as the effective wavelength of the roentgen-ray beam in question.

If two films, one of which is covered by a metal shield and the other unshielded, are exposed to roentgen rays, the quality of the rays striking each film will not be the same. The density of the photographic blackening of the shielded film will be a function of both the spectral sensitivity and the amount of roentgen rays transmitted through the metal. If several such pairs of films are exposed to roentgen rays of various effective energies, the density ratio of unshielded film to shielded film is found to be a function of the roentgen-ray energy. Once this relationship is quantitatively established, then, conversely, the effective roentgen-ray energy can be deter-

* Patent proceedings have been initiated on the device and method described in this article.

mined by measuring these ratios. It is thus possible to design a film badge dosimeter within the energy dependent region which will indicate the effective energy of the radiation striking the film. Once the effective energy has been determined, it is then possible to determine the roentgen exposure from the net density of either film. Such a dosimeter is described in this report.

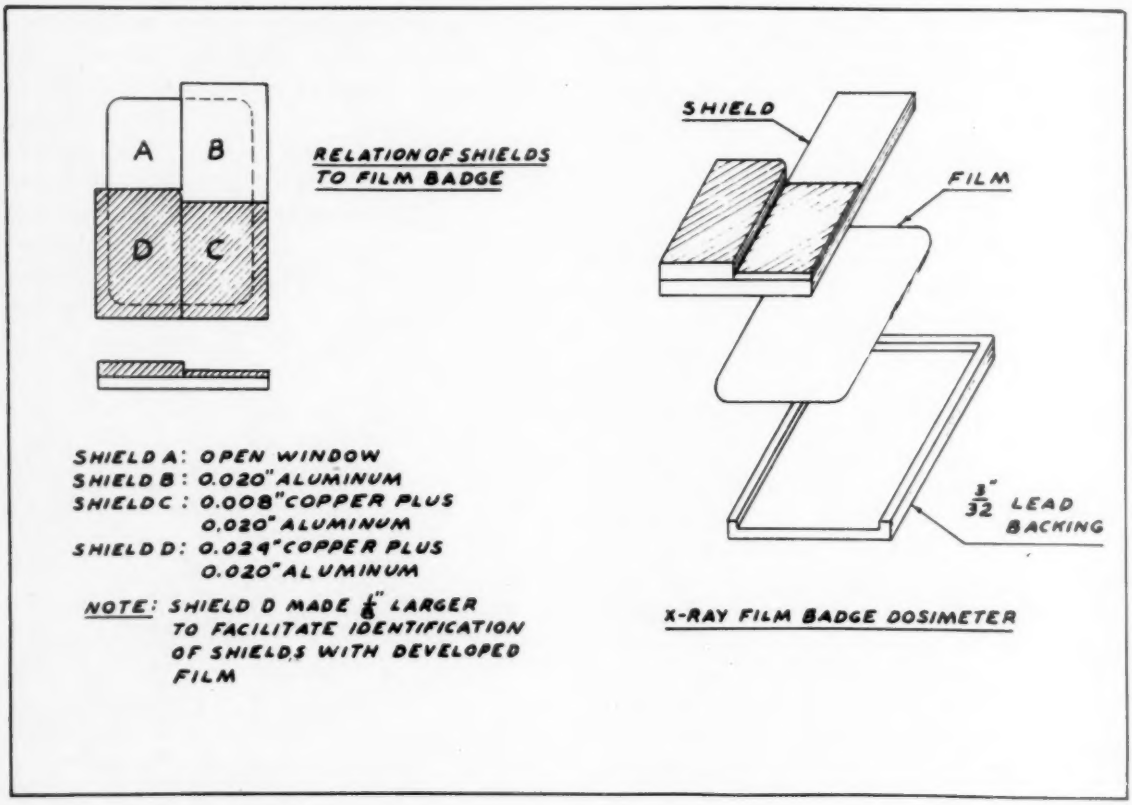

FIG. 1

The film badge dosimeter is divided into four areas, consisting of an open window region and an echelon of three metal shields (Fig. 1). The echelon consists of a 0.020 inch aluminum shield which covers three-quarters of the film area. Two copper strips 0.008 inch and 0.024 inch thick are placed over the aluminum shield so that the echelon contains the following steps: first, 0.020 inch aluminum; second, 0.008 inch copper plus aluminum; third, 0.024 inch copper plus aluminum. The back of the film badge is a sheet of lead 0.094 inch thick, so that roentgen rays can strike the film from the front side only.

The effective energy of the roentgen rays is determined by observing film density ratios under two adjacent shields. For very low energies either the ratio of open window readings to the density under the aluminum shield or the densities under the aluminum and 0.008 inch copper shield are utilized. For greater effective energies, the ratios between the two copper shields are used. For each density ratio between two adjacent shields there is assigned a multiplying factor which, when multiplied by the net density under a given shield, will give the radiation intensity in roentgen units.

Both DuPont type 552 insensitive film and Eastman Radiatized type DF-7 dental film have been calibrated for use with the film badge dosimeter.

PROCEDURE

A Westinghouse Medical 140 kv. (peak) rotating anode roentgen-ray tube with an inherent filtration of 0.5 mm. aluminum was used as the radiation source for effective energies from 17.0 to 25 kv. Effective energies of 25 kv.and above were obtained from a Picker 250 kv. (peak) industrial roentgen-ray unit possessing an inherent filtration of 3.0 mm. of aluminum. Radiation intensities were measured with a Victoreen condenser r-meter and a 0.25 r thimble chamber which was calibrated by the National Bureau of Standards for roentgen-ray energies of 20 kv. (peak) and above.[2]

Throughout the report the quality of all roentgen-ray exposures is given in terms of effective energy rather than effective wavelength or half-value layer, which are the common terms used in roentgen-ray work. Energy and wavelength are related to each other by the equation:

$$\text{Effective energy (kv.)} = \frac{12.350}{\text{Effective wavelength (Å)}}$$

This departure is more consistent with the units of energy used in atomic energy work and the associated fields where radiation energies are expressed in terms of electron volts rather than their corresponding spectral wave lengths.

Effective energies were obtained by taking half-value layer absorption measurements, using aluminum as an absorber for energies to 36 kv. and copper for energies greater than this value. Victoreen's[5] table of absorption coefficients was used to determine the effective wavelengths, which in turn were translated to effective energy.

Both DuPont type 552 insensitive film and Eastman Radiatized type DF-7 dental film were exposed simultaneously throughout the experiment. Five exposures were made at each of the various tube potentials listed in Table 1. The films were exposed in four groups: group one was unshielded; group 2 was shielded by 0.020 inch aluminum; group 3 was shielded by 0.008 inch copper plus 0.020 inch aluminum; and group 4 was shielded by 0.024 inch copper plus 0.020 inch aluminum. Each group consisted of five DuPont and five Eastman films which received 0.5 r, 1.0 r, 1.5 r, 2.0 and 2.5 r respectively. All films were backed with lead. Later, film badges of the type illustrated in Figure 1 were constructed and the calibration was repeated. Three films of each type were exposed in film badge holders to 1 r at each kilovoltage. This was repeated for every kilovolt (peak) listed in Table 1.

A copper penetrameter ranging from 0.008 inch to 0.08 inch in 0.008 inch steps and a series of aluminum shields 0.02 inch, 0.040 inch, 0.10 inch, 0.20 inch and 0.30 inch thick were initially used to determine the thickness of shields and shield material to be used in the film badge dosimeter. Eastman and DuPont films were placed under the copper penetrameter and aluminum shields, and exposed to radiation intensities of 1 r over the range of energies indicated in Table 1. The filters selected, shown in Figure 1, were those that gave the desired film badge sensitivity range and ratio characteristics.

Eastman Liquid Developer at a temperature of 68° F. was used to process the film. DuPont film was developed for three minutes and dental film was developed for seven minutes. Density readings were taken with an Ansco-Sweet densitometer calibrated by an Ansco-Sweet densitometer film reference wedge to a density of 3.0.

DISCUSSION

Film Badge Requirements. Certain film requirements must be met in order to realize a completely satisfactory type of dosimeter. Ideally, the film's developed density should be a linear function of the radiation dose received. Without this property the film ratio for a given voltage will not be constant for different radiation intensities. The film should be of the proper sensitivity so that the desired intensity range can be covered. DuPont insensitive type 552 film and Eastman Radiatized type DF-7 dental

TABLE I

Tube	Kv. (peak)	Filter (mm.)	Output r per min.	Half-Value Layer (mm).	Effective kv.
A	30	Minimum	0.76	0.45 Al	17.0
A	40	Minimum	1.03	0.55 Al	18.0
A	50	Minimum	0.90	0.65 Al	19.5
A	50	2.5 Al	0.63	1.42 Al	25.0
B	50	0.5 Al	0.24	1.42 Al	25.0
B	70	0.5 Al	0.83	2.1 Al	29.5
B	80	1.4 Al	0.91	3.0 Al	34.0
B	90	2.5 Al	0.91	3.8 Al	37.5
B	100	5.0 Al	0.79	5.0 Al	42.0
B	110	0.2 Cu	0.95	0.30 Cu	50.0
B	110	0.4 Cu	0.59	0.42 Cu	56.0
B	110	0.6 Cu	0.42	0.49 Cu	60.0
B	130	0.8 Cu	0.48	0.67 Cu	68.0
B	130	1.0 Cu	0.38	0.75 Cu	71.0
B	130	1.4 Cu	0.24	0.80 Cu	73.0
B	150	1.6 Cu	0.40	1.15 Cu	84.0
B	170	2.2 Cu	0.24	1.40 Cu	90.0
B	190	2.8 Cu	0.26	1.60 Cu	98.0
B	210	3.6 Cu	0.36	2.4 Cu	120.0
B	250	4.2 Cu	0.77	3.0 Cu	134.0
B	250	1.1 mm Pb+ 0.6 mm Cu	0.47	3.6 Cu	150.0

NOTE: *Tube A:* Rotating anode medical unit; inherent filtration 0.5 mm Al.
Tube B: Industrial unit; inherent filtration 3.0 mm. Al. All exposures made at 50 inch distance.

film were both found to meet the requirements of a satisfactory film. They are able to cover a minimum range of intensities from 0.1 to 2.0 r for roentgen-ray energies from 15 to 150 kv. effectively and possess a greater range of intensities over most of the spectrum. Eastman dental film is linear only to a density of 2.5, but the use of a correction table enables one to compensate for this non-linearity. Table II lists the correction to be applied for a total density greater than 2.5. The net density for dental film is defined as the corrected total density (for densities greater than 2.5) minus the fog.

TABLE II

DENTAL FILM DENSITY CORRECTION TABLE

(Corrections are to be applied to total density readings observed on the densitometer)

Total Density Readings	Corrected Total Density Readings
2.50	2.50
2.55	2.58
2.60	2.66
2.65	2.74
2.70	2.82
2.75	2.90
2.80	2.98
2.85	3.06
2.90	3.14
2.95	3.22
3.00	3.30

Of the two films chosen for investigation, DuPont 552 insensitive film possesses the most desirable characteristics. The film is linear for all readable densities and is uniformly sensitive over its entire area. The DuPont type 552 film packet contains two films, sensitive and insensitive, and was specifically designed for radiation monitoring of beta and gamma rays over a wide range of radiation intensities.

The initial film badge design consisted of a conventional step wedge echelon

shield, but was changed to the type of badge described in Figure 1 for the following reason. It was found that the dental film fog density was slightly greater around the edge due to excess pressure exerted by an extra thickness of paper in this region. This condition is quite pronounced for older film. In general, density measurements should not be made within one-eighth of an inch from the edge of the film. In the present film badge dosimeter, all density measurements may be made towards the center of the film where, under normal conditions, the fog density is very uniform.

RESULTS

Figures 2 through 5 show the linearity of the density vs. roentgen dose characteristics of DuPont and Eastman films at four different energies. All experimental points represent net densities of individual films exposed under individual shields obtained by subtracting the fog from the total density of the film. For Eastman film densities greater than 2.5, both observed and corrected readings have been plotted. Figures 6 and 7 are plots of DuPont and Dental films respectively with 1 r exposures under the three metal shields and open window readings of the film badge for effective energies from 17.0 to 150 kv. The dotted line represents the density of a film completely covered by shield C. It is observed that the film density under shield C of the film badge is greater than when a film is exposed under shield C alone. This increase is attributed to a certain amount of scattering produced from the proximity of one shield to another. A proportionate increase in density occurred when the remaining three shields were compared in the same manner. The linearity of film under all four shields of the film badge was identical to the linearity observed in Figures 2 to 5.

Table III lists the density ratios of any two adjacent shields of the film badge for both DuPont and Dental films and the corresponding effective energy, effective wavelength, and half-value layer. Table IV lists the density ratios for DuPont type 552 insensitive film between any two adjacent shields together with the associated multiplying factor. The multiplying factor indicates the amount by which the net density under a particular shield must be multiplied in order that the exposure received can be converted to roentgens. The multiplying factor is the reciprocal of the density obtained for a 1 r exposure at any given effective energy as shown in Figures 6 and 7. Table V presents the same information for Eastman DF-7 dental film. Figures 8 and 9 present the tabulated results of Tables IV and V as plotting density ratios vs. multiplying factor. A discussion on the use of the tables and graphs will be found in the appendix.

Film Badge Limitations. Reference to Figure 7 indicates that the film under the three metal shields of the film badge reaches a position of maximum sensitivity somewhere between an effective energy of 35 and 75 kv., depending on the shield in question. If a film badge is exposed to energies on either side of the peak, the resulting readings will not give a true indication of the roentgen dose received. Film badge exposures were made at two extremes of energies, the dosimeter being exposed to 1 r at an effective energy of 33 kv. and then to 1 r at 134 kv. The ratios between shields C and D were read and the exposures determined. The radiation received was found to be 1 r, which is one-half of the actual dose received. This condition represents the maximum error that would be encountered with such a dosimeter. The error is consistent with the inherent limitation of photographic emulsion in the roentgen-ray region and cannot be avoided. Exposures at such extreme voltages will, in practice, be uncommon and in medical work would occur only if operators of deep therapy equipment should devote part of their time to diagnostic work or superficial therapy.

Personnel engaged in diagnostic work, roentgenoscopy, or superficial therapy are ordinarily exposed to roentgen rays up

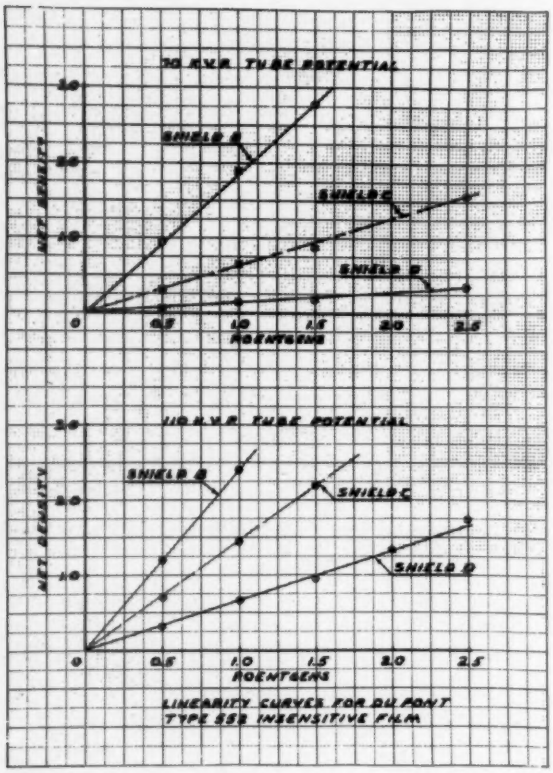

FIG. 2

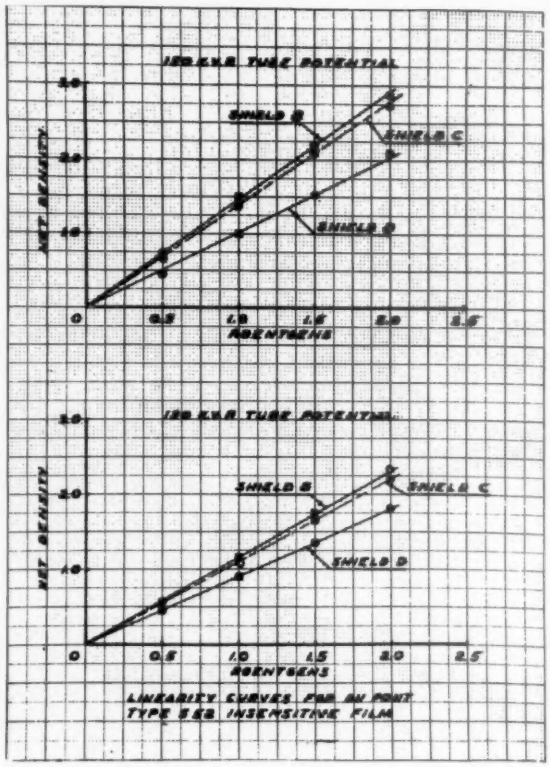

FIG. 3

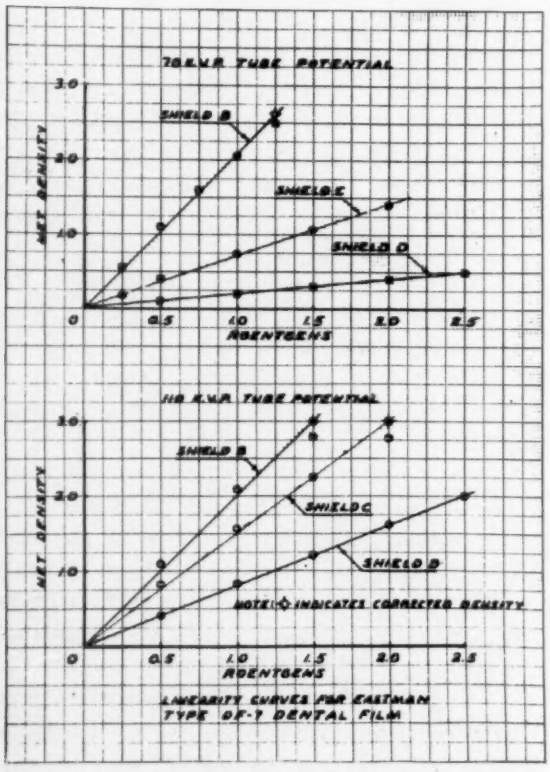

FIG. 4

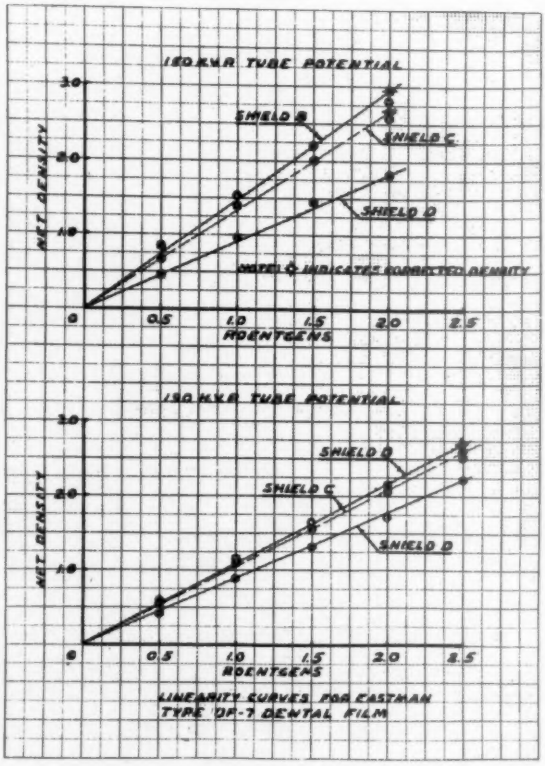

FIG. 5

to 100 kv. (peak) potential filtered by no more than 1 mm. aluminum. The maximum effective energy of such a beam would correspond to 30 kv. and is well below the region of maximum sensitivity of the film. Exposures within the diagnostic range of

Deep therapy begins at about 200 kv. (peak) with filtration of 0.5 to 1 mm. of copper, which corresponds to an effective energy of approximately 100 kv. Scattered radiation from this beam will be of a somewhat lower energy. From the Compton

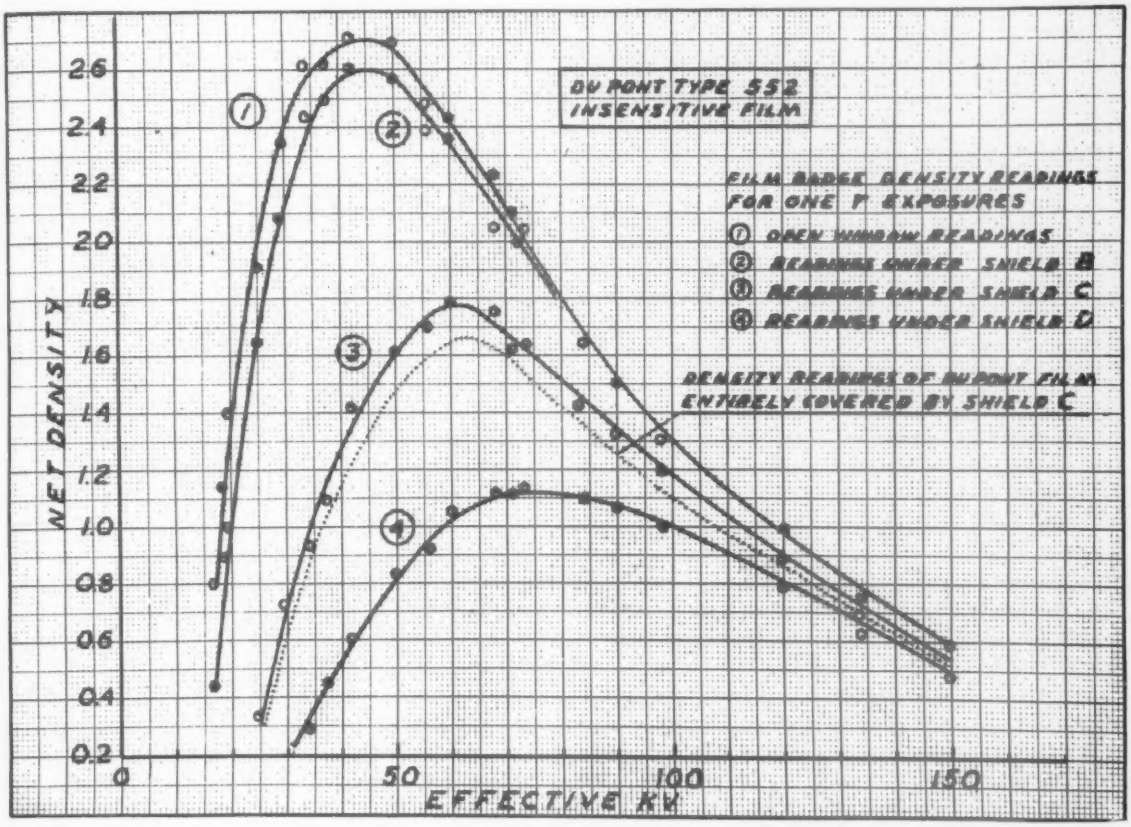

Fig. 6

energies would not be subjected to the type of error discussed above.

The intermediate therapy range extends to roentgen-ray potentials of 140 kv. (peak) and filtration is sometimes as heavy as 0.25 mm. copper plus 1 mm. aluminum, with a corresponding effective energy of approximately 50 kv. This energy is below the region of maximum film sensitivity for that portion of the film under the two copper shields. The film under the aluminum shield is at a maximum sensitivity for 50 kv. Personnel could be engaged in both diagnostic and intermediate therapy work and still obtain valid readings with such a dosimeter.

scattering equation:

$$\Delta\lambda = 0.0242\ (1-\cos\theta)\ \text{Ångströms},$$

and from the equation:

$$\text{kv.} = \frac{12.350}{\lambda\ (\text{Å})},$$

100 kv. roentgen rays scattered through 180 degrees are reduced to energies of 72 kv. It is quite likely that personnel engaged in deep therapy work will not be subject to radiation energies below 72 kv. Reference once more to Figure 7 indicates that the film badge dosimeter could be used in this region and would give an accurate interpretation of radiation dose received.

Film badges were exposed to extremes of energy within each range of the three radiation techniques discussed. The largest observed error from these measurements was found to be 25 per cent and can be assigned as the limit of accuracy of the dosimeter. In general, the accuracy that can be realized with the roentgen-ray film badge dosimeter depends upon the type of irradiations being performed and the range of energies within which they are made.

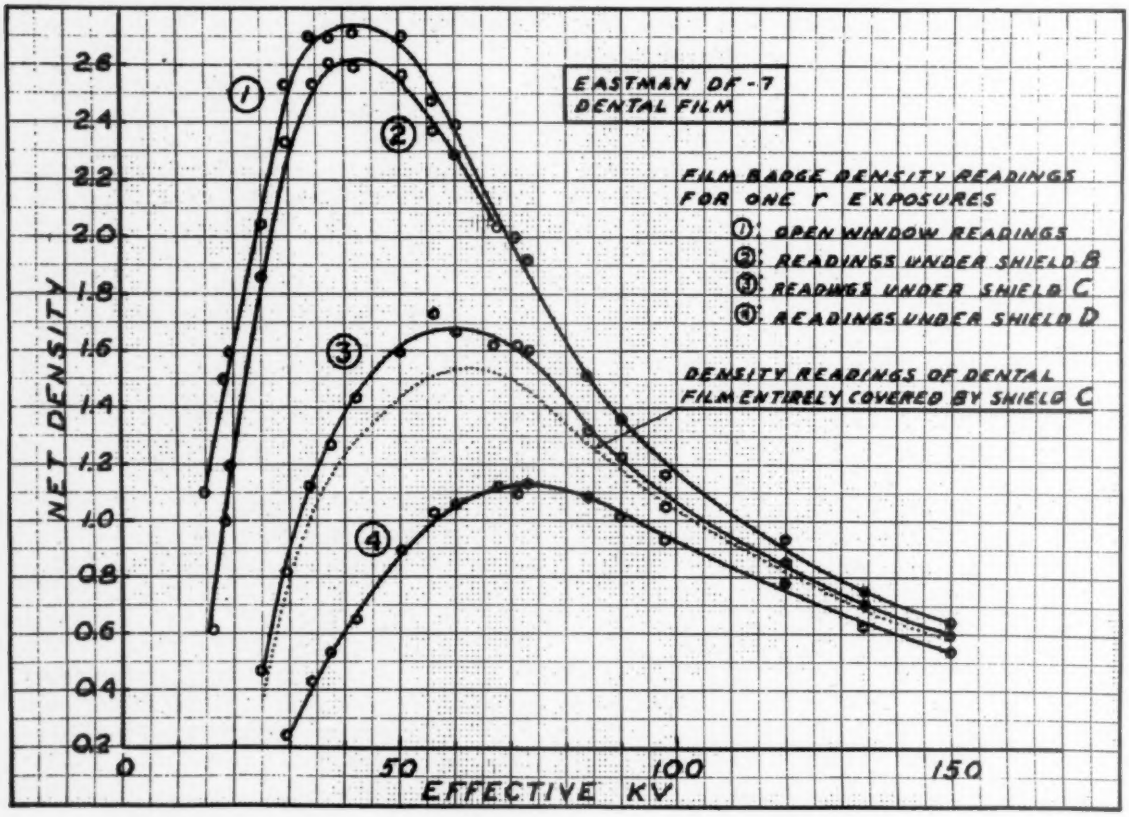

FIG. 7

FILM DEVELOPING TECHNIQUES

Normal film badge dosimetry practice consists of running a calibration curve on a set of films which have received a known exposure every time a group of films is developed. Such a procedure minimizes any errors that might arise from the many variable factors involved in the developing process. It is not uncommon to find variations as high as 20 per cent between calibration curves run at different times under seemingly identical developing conditions.

Since the data necessary to interpret the radiation received by the roentgen-ray film badge dosimeter necessitated the development of over a thosand films, the practice of running calibration curves could not possibly be considered. Furthermore, the tables presented for the interpretation of radiation dose are valid only if developing techniques are standardized with those in the original work. In view of these facts, it was necessary to adopt a somewhat different method of standardizing film developing techniques.

If a dosimeter using either type film is exposed to a given amount of roentgen-ray energy, the net density that should be obtained under proper developing conditions can be obtained from Figures 6 and 7. The actual density read on the film will

Table III

Eastman DF-7 Dental Film			DuPont Type 552 Insensitive Film			Effective kv.	Effective Wavelength (Å)	Half-Value Layer	
	Ratio			Ratio					
A/B	B/C	C/D	A/B	B/C	C/D			Al (cm.)	Cu (mm.)
1.80			1.80			17.5	.706	.051	
1.65			1.70			18.0	.686	.055	
1.45			1.50			19.0	.650	.063	
1.35			1.40			20.0	.617	.073	
1.30			1.32			21.0	.588	.085	
1.25			1.27			22.0	.561	.094	
1.21			1.23			23.0	.537	.11	
1.19			1.21			24.0	.515	.12	
1.16	5.0		1.19	5.3		25.0	.494	.14	.04
1.15	4.4		1.18	4.4		26.0	.475	.15	
1.14	3.9		1.17	3.9		27.0	.458	.17	.05
	3.5			3.5		28.0	.441	.18	
	3.2			3.2		29.0	.426	.20	
	2.9	3.7		3.0	3.7	30.0	.412	.22	.07
	2.6	3.5		2.8	3.5	31.0	.398	.23	
	2.5	3.3		2.6	3.3	32.0	.386	.26	.08
	2.4	3.1		2.5	3.1	33.0	.374	.28	.09
	2.3	2.9		2.4	3.0	34.0	.363	.30	
	2.2	2.7		2.3	2.8	35.0	.353	.32	.10
	2.1	2.6		2.2	2.7	36.0	.343	.34	.11
	2.0	2.4		2.0	2.5	38.0	.325	.39	.13
	1.9	2.3		1.9	2.3	40.0	.309	.43	.15
	1.75	2.10		1.75	2.10	45.0	.275	.57	.22
	1.60	1.90		1.60	1.95	50.0	.247	.71	.31
	1.48	1.75		1.48	1.85	55.0	.225	.83	.40
	1.37	1.62		1.37	1.72	60.0	.206	.91	.49
	1.28	1.51		1.30	1.60	65.0	.190	1.0	.60
	1.22	1.43		1.24	1.50	70.0	.177		.73
	1.18	1.35		1.19	1.41	75.0	.165		.86
	1.16	1.30		1.16	1.34	80.0	.155		1.0
	1.14	1.25		1.13	1.28	85.0	.145		1.2
		1.20			1.24	90.0	.137		1.4
		1.18			1.21	95.0	.130		1.5
		1.16			1.19	100.0	.124		1.7
		1.15			1.17	110.0	.112		2.0
		1.14			1.15	120.0	.103		2.4
		1.12			1.13	130.0	.095		2.8

depend upon such factors as: time of development, temperature of developer, amount of agitation, age and condition of developer. Fresh developer and carefully controlled developing techniques should produce the desired film density within rather close limits. Should the observed density be higher or lower than desired, the required density can be produced by developing another identically exposed film for a shorter or longer time. The r dose of any other film developed for this period of time can then be determined by reference to Tables IV and V. Consistent reproduction of developing technique can be obtained by exposing a group of films, designated as Density Standards, to a known amount of radiation so that the net density of properly developed standards is 1.5. Density Standards for both DuPont and Eastman films

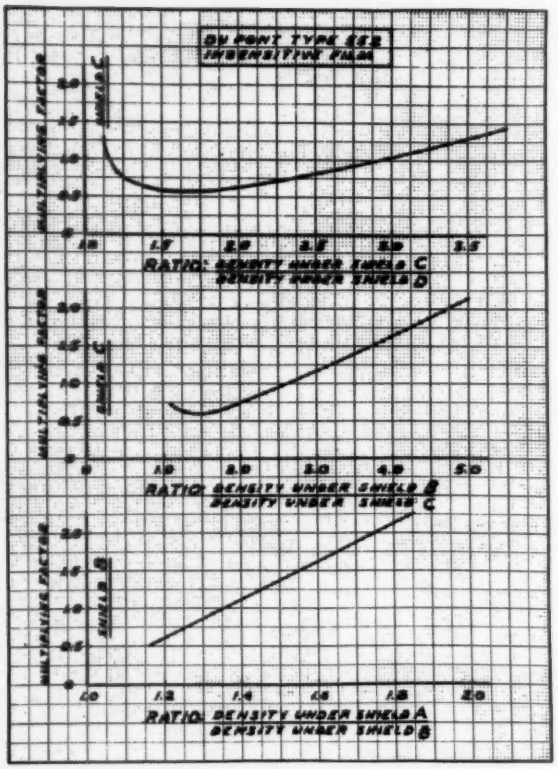
DU PONT TYPE 552
INSENSITIVE FILM
MULTIPLYING FACTOR
SHIELD C
RATIO: DENSITY UNDER SHIELD C / DENSITY UNDER SHIELD D
SHIELD B
RATIO: DENSITY UNDER SHIELD B / DENSITY UNDER SHIELD C
SHIELD A
RATIO: DENSITY UNDER SHIELD A / DENSITY UNDER SHIELD B

FIG. 8

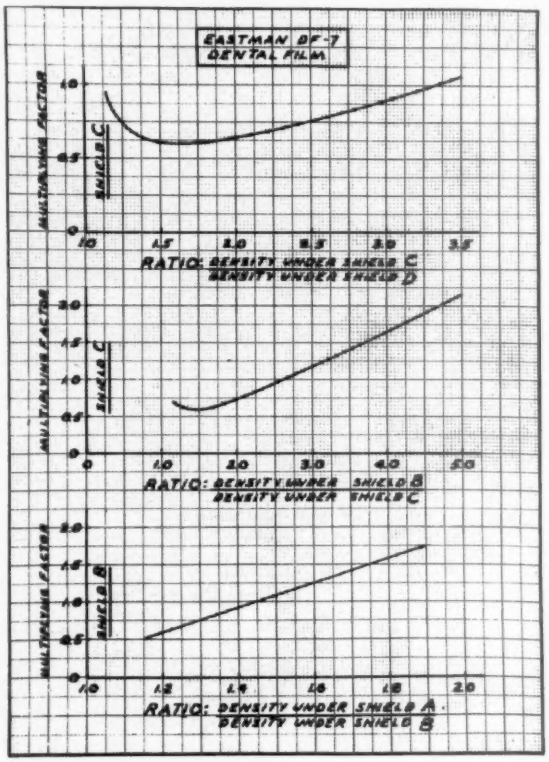
EASTMAN DF-7
DENTAL FILM
MULTIPLYING FACTOR
SHIELD C
RATIO: DENSITY UNDER SHIELD C / DENSITY UNDER SHIELD D
SHIELD B
RATIO: DENSITY UNDER SHIELD B / DENSITY UNDER SHIELD C
SHIELD A
RATIO: DENSITY UNDER SHIELD A / DENSITY UNDER SHIELD B

FIG. 9

were obtained by first shielding the films with 0.008 inch copper plus 0.020 inch aluminum and exposing the films to 130 kv. (peak) roentgen rays, filtered by 0.8 mm. copper (effective energy, 68 kv.). Roentgen-ray exposures required to give a net density of 1.5 were 0.91 r for DuPont type 552 insensitive film (Fig. 6) and 0.98 r for Eastman Radiatized DF-7 film (Fig. 7). Proper developing time will be considered that which will develop a Density Standard to a net density of 1.5 ± 0.15.

TABLE IV

RATIOS AND MULTIPLYING FACTORS FOR DUPONT TYPE 552 INSENSITIVE FILM

Ratio A/B	M. F. Shield B	Ratio B/C	M. F. Shield C	Ratio C/D	M. F. Shield C
1.9	2.35	5.0	2.15	4.0	1.55
1.8	2.10	4.5	1.90	3.5	1.30
1.7	1.85	4.0	1.60	3.0	1.05
1.6	1.60	3.5	1.40	2.5	0.85
1.5	1.35	3.0	1.20	2.0	0.65
1.4	1.10	2.5	0.95	1.8	0.55
1.3	0.85	2.0	0.75	1.6	0.55
1.2	0.60	1.8	0.65	1.5	0.60
1.16	0.50	1.6	0.60	1.4	0.65
		1.4	0.60	1.3	0.70
		1.2	0.65	1.2	0.85
		1.16	0.70	1.16	1.05

TABLE V

RATIOS AND MULTIPLYING FACTORS FOR EASTMAN DF-7 DENTAL FILM

Ratio A/B	M. F. Shield B	Ratio B/C	M. F. Shield C	Ratio C/D	M. F. Shield C
1.9	1.75	5.0	2.15	3.5	1.05
1.8	1.55	4.5	1.9	3.0	0.90
1.7	1.40	4.0	1.65	2.5	0.75
1.6	1.25	3.5	1.4	2.0	0.65
1.5	1.05	3.0	1.25	1.8	0.60
1.4	0.9	2.5	0.95	1.6	0.60
1.3	0.75	2.0	0.75	1.5	0.60
1.2	0.6	1.8	0.70	1.4	0.65
1.15	0.5	1.6	0.60	1.3	0.70
		1.4	0.60	1.2	0.80
		1.2	0.65	1.16	0.95
		1.16	0.70	1.14	1.18

It was felt that the usefulness of the film badge dosimeter could be extended if developing techniques were devised to allow the use of more than one type of developer. Three developers were tried: Eastman Liquid Developer, Eastman Rapid Powder Developer (Kodak Formula), and Eastman Standard Powder Developer. They are perhaps typical of the different types of developers that might be found in different roentgen-ray installations. Density Standards were developed for different times in the three developers to obtain developing times which would give a net density of 1.5 for all three solutions. Two sets of films, exposed to various radiation intensities at 100 kv. (peak) and 200 kv. (peak), were developed in each of three developers for the predetermined proper developing time. Figure 10 indicates that once the proper developing time has been established for any of the three developers or their equivalents, they will all produce identical results over the range of energies of the film badge dosimeter. Any of the three developers mentioned, or equivalents, can be used in the processing of the roentgen-ray film badge dosimeter.

Liquid roentgen-ray developer was diluted to varying concentrations so as to require greater developing times to obtain a net density of 1.5 and two sets of films (as above) were developed at the different concentrations. It was found that as long as the developer had sufficient strength to develop a Density Standard to a net density of 1.5 in a reasonable period of time, it could be used satisfactorily. It appears that a developer in almost any condition could be used, provided it could develop a

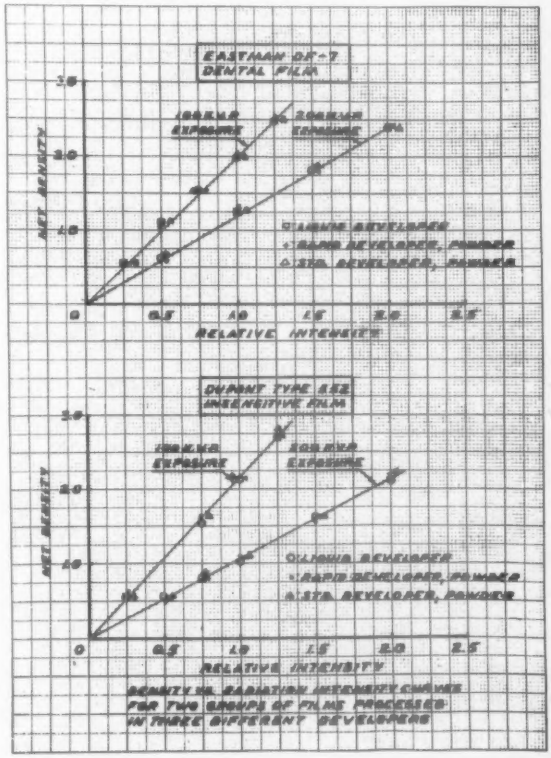

FIG. 10

standard film to the required density.

Table VI gives the recommended developing time for either DuPont or Eastman film in three different developers. All times are given for a developing temperature of 68° F. and for fresh solutions. Included in Table VI is a development time correction equation which indicates the required change in developing time whenever a Density Standard is developed to a density other than 1.5 ± 0.15. The equation resulted from data obtained by developing the standards in freshly mixed developers for increasing periods of time.

TABLE VI

A. Recommended developing times for fresh developer:

Developer	Eastman DF-7 Dental Film	DuPont Type 552 Insensitive Film
Eastman X-ray Liquid	7 min.	3 min.
Eastman X-ray Rapid (Kodalk formula)	7 min.	4 min.
Eastman X-ray Powder	8 min.	6.5 min.

For temperatures other than 68° F.: increase developing time 7 per cent per degree F. if temperature is below 68° F.; decrease developing time 6 per cent per degree F. if temperature is above 68° F.

B. Developing time correction in minutes for density standards developed to a net density other than 1.5: (for fresh solution only)

1. *Eastman DF-7 Dental Film.*
   $\Delta t(\text{min.}) = 10\,(1.5 - \text{net density of standard})$
2. *DuPont 552 Insensitve Film.*
   $\Delta t(\text{min.}) = 3\,(1.5 - \text{net density of standard})$

In some cases it might appear simpler to develop film badges together with a Density Standard for a given length of time and, if the standard reads other than 1.5 ± 0.15, multiply all results by the proper correction factor. Readings made in this manner may not be valid, since the density of the film is not a linear function of its developing time.[1] It is therefore deemed advisable not to exceed the recommended limits. Moreover, the three different developers were compared only within these regions, and no conclusions can be made as to their relative behavior at other developing times.

DETERMINATION OF QUALITY OF A ROENTGEN-RAY BEAM

Aside from its use as a dosimeter, the film badge can also be used to determine the quality of any roentgen radiation, direct or scattered or a combination of the two. It provides a simple and direct method of measuring quality and requires a minimum of equipment. The quality of scattered radiation from phantoms and within phantoms or other specimens could readily be surveyed, whereas ion chamber absorption methods might be cumbersome under such conditions. It also provides a rapid means of evaluating roentgen-ray energy in a complex radiation field. In Table III the effective energy for all shield density ratios is given in terms of effective kilovoltage, effective wavelength, and half-value layer. With this table anyone using the data can readily convert the information to whatever definition of quality may by desired.

SUMMARY

A roentgen-ray film badge dosimeter has been described which allows a quantitative interpretation of the roentgen dose received for effective roentgen-ray energies of 15 to 150 kv. Both DuPont type 552 insensitive film and Eastman Radiatized type DF-7 dental film have been calibrated, and either can be used with the dosimeter. The film is covered by an echelon of three metal shields, plus an open window region. Tables are presented in which the ratio of densities between two adjacent shields determine a factor, which, when multiplied by the net density under one of the shields, gives the radiation dose directly in roentgens. Data are also included which allow the dosimeter to be used to determine the quality of roentgen radiation, direct or scattered, striking the film badge. Proper processing of exposed films is accomplished by a one-point calibration check which

consists of developing a pre-exposed standard film for various developing times until a net density of 1.5 ± 0.15 is obtained. Films can be developed either in Eastman Liquid Developer, Eastman Rapid Powder Developer (Kodalk Formula), Eastman Standard Powder Developer, or equivalents.

APPENDIX

Procedure for Using Roentgen-Ray Film Badge

1. *Determination of proper developing conditions.* Proper developing time is defined as the time required for any given developer to develop a Density Standard film to a net density of 1.5 ± 0.15. Table VI–A gives the recommended developing times for DuPont and Eastman film for three types of developer and represents observed averages rather than aboslute developing times. Initially, a Density Standard will be developed for the recommended time. Should the density read other than 1.5 ± 0.15, correct development time is obtained from the correction equation of Table VI-B.

As an example, suppose that an Eastman Dental Film Density Standard is to be developed in a fresh solution of Eastman Liquid Developer, or equivalent. Reference to Table VI indicates a seven minute developing time. The film and an unexposed control film are developed together. The net density is found to be 1.75. From Table VI, for Eastman film and fresh solution:

$$\Delta t(\text{min.}) = 10(1.5 - \text{net density of standard})$$
$$= 10(1.5 - 1.75) = -2.5 \text{ minutes.}$$

Corrected developing time $= 7 - 2.5 = 4.5$ minutes. A Density Standard developed for the corrected time will read approximately 1.50. Two Density Standards should be developed together with every group of film badges and the average taken as an indication of developing conditions.

For example, should a standard read 1.35, all films developed for this time will read low and should be multiplied by the ratio 1.5/1.35 in order to read correctly. Similarly, a standard reading 1.60 will indicate that films developed under this condition will read high and must be multiplied by the ratio 1.5/1.6.

By rinsing the Density Standards in a wetting agent or alcohol after washing, and by drying the film in a current of warm air, it was possible to make density readings within a few minutes after the film left the film bath. When such a procedure is used the determination of proper developing time can be made very quickly.

The developing process can be summarized as follows:

1. Develop Density Standard and control to recommended developing time (Table VI). Correct all temperatures to 68° F.
2. Rinse films in alcohol or wetting agent and dry in a current of warm air if speed is desired.
3. Read net film density.
4. If film density is other than 1.5, apply the necessary time corrections as determined by the equation in Table VI.
5. Develop film badges together with two Density Standards for the determined correct developing time.
6. Read average net density of the standards. For average net density other than 1.5, the proper correction must be applied to all calculated roentgen exposures.

2. *Procedure for interpreting developed film badge dosimeters.* In view of the fact that there are four possible density readings on a film badge, it might at first appear rather difficult to determine which ratio to choose in determining the radiation dose received. Actually, the density ratio between any two shields can be used to determine the radiation dose. A simple method to determine which ratio to use is to hold the film to a source of light and note which of two adjacent density regions is the most pronounced. In many cases it will be observed that the density under one or two shields is greater than 3 or that no exposure exists. It is to be noted that for effective energies greater than approximately 30 kv. the ratio of shield A/shield B is changing very slowly and should not be used in this region.

As an example, suppose that Eastman dental film was developed and the following readings under the different shields were observed:

	A	B	C	D	S
Total	2.62	2.58	1.82	1.10	1.60
Correction	2.70	2.63	1.82	1.10	1.60
Control	.20	.20	.20	.20	.20
Net	2.50	2.43	1.62	0.90	1.04

All Eastman dental film total densities greater than 2.5 are corrected to the values indicated in Table II. The ratio of shield A/shield B will not be used.

From the recorded net densities

$$\frac{D_B}{D_C} = \frac{2.43}{1.62} = 1.5$$

$$\frac{D_C}{D_D} = \frac{1.62}{0.90} = 1.8$$

From either Figure 9 or Table v the multiplying factor for shield C is found to be 0.6 for both ratios.

$$\text{r dose received} = 1.62 \times 0.6 = 0.97$$

However, the Density Standard was developed to a density of 1.4 rather than 1.5 which indicates all calculated radiation intensities will read low, and must be multiplied by the factor 1.5/1.4.

$$\text{Corrected r dose} = 0.97 \times \frac{1.5}{1.4} = 1.04 \text{ r.}$$

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Vol. 64, No. 3

DOSIMETRY OF IONIZING PARTICLES*

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THE large scale experimentation and technology connected with the development of atomic energy have resulted in a greatly increased production and utilization of corpuscular ionizing radiations. As a result, the problem of measurement of these radiations has become much more acute. The problem is the same that confronted early workers in the roentgen-ray field and it is essentially two-fold. One question concerns the establishment of a suitable unit and the other the accurate measurement of radiations in terms of that unit.

While the definition of a unit has to precede the actual measurement, the unit is often defined with a specific method of measurement in mind. Thus the 1928 definition of the roentgen was essentially in terms of a parallel plate ionization chamber and in the more recent case of neutrons the n unit was defined directly in terms of a commercial ion chamber. In both cases the resulting unit becomes ambiguous or completely useless as soon as it is attempted to apply it to radiations that cannot be properly measured by the instrument. The old roentgen had to abandoned as roentgen rays of high energy came into use and the n unit would be quite useless, if applied to thermal neutrons.

While at present there is no international unit of quantity of ionizing corpuscular radiations, the roentgen being defined only for electromagnetic radiations, a variety of units has been suggested. The most comprehensive and most commonly used of these is the equivalent roentgen, or rep. (H. M. Parker). Here the basis is energy absorbed per gram of tissue, 1 rep. corresponding to the absorption of 83 ergs/gram. In the light of our present knowledge of the subject this is probably the most fundamental quantity involved in the physical process and the unit may be applied to any ionizing radiation. However, instead of the unit defined in terms of an ionization chamber, we are now dealing with the unit for which a proper ionization chamber has to be designed.

The problem is comparatively simple if the radiation consists of charged particles such as betas, protons, etc., at energies below a few million electron volts. Here the energy absorption is a highly localized process. The particle generates ions along its path and since these ions together with some, also locally produced, excited atoms represent virtually the entire energy loss of the primary radiation, the dose at a given point is practically independent of the nature of its immediate surroundings. Here the word "immediate" is meant to imply actual tissue distances as small as a micron or so. Under these conditions it is possible to substitute for a small volume of tissue a corresponding volume of tissue equivalent gas, i.e., a mixture of gases that has the same atomic constitution as tissue. A good approximation may be obtained from a mixture of hydrogen, carbon dioxide, and small amounts of oxygen and nitrogen. Since Bragg's law states that the amount of energy imparted by ionizing radiations does not depend on the molecular arrangement of absorbing atoms, the energy loss per gram of tissue equivalent gas will be equal to the energy absorbed per gram of actual tissue. The ion current in the gas volume is related to the energy imparted through the quantity W, the average energy expended in the production of an ion pair. Fairly good values for W exist in the literature and therefore a tissue dose in terms of equivalent roentgens may be readily measured by determining the ionization current in a known mass of tissue equivalent gas. In-

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deed, one may go a step further and simply measure the ion current in air. Multiplying this value by W for air will give the energy loss in air, and multiplying in turn by the relative stopping power of tissue to air, another well known quantity, one may again arrive at a good value of the tissue dose in ergs per gram. The nature of walls of the ion chamber used for such measurements is immaterial as long as allowance can be made for the wall absorption of the radiation.

This comparatively simple method of measurement must be abandoned as soon as the primary radiation creates secondary radiations of appreciable range. In fact, it should be pointed out that even for the radiations discussed, this method is not strictly correct. For instance, in the case of alpha particles measured in tissue equivalent gas, a fraction of the energy is dissipated by delta rays, which are knock on electrons. The range of most of these is far less than a millimeter, but a very small fraction of the total energy is carried by delta rays which may range several millimeters. If the rate of delta ray production in the wall is materially different from the one in the tissue equivalent gas, the ion density near the wall will differ from the "true" one near the center of the chamber and an incorrect value will be obtained because the reading given by the chamber will be some sort of average between these two values. Since the dimensions of any practical chamber of this type is likely to be large with respect to the average range of delta rays, the error is quite small.

The situation is quite different, however, if fast neutrons are to be measured. Here all of the energy is carried by secondary radiations, and the range of most of these may be quite considerable. The protons recoiling from 20 mev. neutrons will traverse distances of the order of a millimeter in tissue. As a result, if a beam of neutrons strikes tissue, the ion density due to protons will increase rapidly with depth until a distance equal to the maximum proton range is reached. Beyond that point the energy imparted to a unit volume remains constant (except for a slight obsorption of the primary neutron beam). In this region "irradiation equilibrium" is said to exist. Since according to Bragg's law the energy loss per gram of tissue equivalent gas equals the energy loss per gram of tissue, we can place a small cavity filled with tissue equivalent gas into this tissue and obtain a correct value of the energy imparted by protons from an ionization measurement. This cavity must, however, be placed in the region of irradiation equilibrium, i.e., the point at which the proton contribution is built up to its full value.

It should be pointed out that this cavity may no longer be filled with air. One reason for this is that protons are not the only ionizing recoils generated by fast neutrons. A significant fraction of the energy imparted is carried by oxygen, carbon and nitrogen nuclei which recoil in much the same manner except that their range is very short. An air-filled cavity of practical dimensions would register an ion current having an appreciable contribution from recoils originating in the air rather than the tissue, and hence an error would be introduced. Besides, it can be shown that for a chamber lined with a sufficient amount of tissue equivalent solid and filled with tissue equivalent gas, the energy imparted per gram of gas exactly equals the energy imparted per gram of solid, no matter what the range of the particles or the dimensions of the chamber (provided, of course, that the latter is no larger than the radiation field to be measured). Such a chamber may be used for the measurement of tissue dose of any ionizing radiation, the only uncertainty being the value of W. This value may change from about 32.5 e.v. for electrons to about 36 e.v. for alpha particles, the value for the heavier recoils being somewhat uncertain. However, in most practical cases, a choice of W can be made which may be assumed to lead to an error of less than 10 per cent. Thus the problem reduces itself to the preparation of a tissue equivalent solid which can be

used to line ion chambers. Since the material must have considerable rigidity and permanence, the use of actual tissue is not practical. On the other hand, no solid compounds or mixtures of compounds are known which will provide the required ratio of percentages of hydrogen and oxygen (about 10 and 70 per cent, by weight, respectively).

However, assuming a composition ($C_5H_{40}O_{18}N$) for tissue, a mixture of water, gelatine, glycerin and sucrose may be prepared which will harden into a resilient gel if about 0.5 per cent of formaldehyde is added. This material will remain constant in composition and geometry over considerable periods of time, provided it is kept in a hermetically sealed enclosure to prevent loss of water by evaporation. While the humidity in such an enclosure is high, a polished polystyrene surface will provide sufficiently good insulation in thimble chambers having collecting voltages up to 800 volts.

Since carbon dioxide is soluble in the wall material it may not be utilized as a constituent of the gas in the chamber. This necessitates the use of explosive tissue equivalent gas mixtures, such as a combination of methane, hydrogen, oxygen, and nitrogen. While the W for such mixtures may be obtained from the literature its absolute value need not be known, since it is possible to calibrate the tissue equivalent chamber against an "air wall" chamber, using gamma rays, and to correct readings obtained with neutrons by ratio of 36/32.5, the ratio of W's for protons and electrons in air.

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A NEW TYPE OF ROENTGEN PERISCOPE FOR INTRACAVITARY THERAPY

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INTRACAVITARY therapy was first attempted in a rather crude sort of way by Brickner in 1903. Lack of shock-proof, ray-protected, flexible, compact roentgen tube heads discouraged the development of intracavitary therapy as a routine and standardized technique. Following the development of shock-proof apparatus, those interested in roentgen therapy quickly developed techniques for intracavitary roentgen therapy.

Such treatment made necessary the use of some form of periscopic instrument whereby the therapist could accurately set up the treatment field by direct visualization. Various types of periscopes have been produced and have been for the most part only reasonably satisfactory.

The effectiveness of a periscope depends on how well one can see the parts he proposes to treat. Good visualization requires a good reflecting surface of adequate size and good lighting.

The chief criticisms of existing periscopes are: (1) unsatisfactory reflecting surface; (2) inadequate lighting.

The reflecting surface has been unsatisfactory in some cases because a composition type of material has been used upon which a good reflecting surface cannot be made. In such cases one starts out with a highly unsatisfactory mirror, and, with use, the poor reflecting surface rapidly becomes worse. To correct this problem, a special thin type of glass mirror should be used. This mirror can be used in a fixed position in the periscope. By so doing, however, the output of radiation with ordinary techniques is reduced about 20 per cent and the treatment time accordingly increased. This is not a serious drawback. More objectionable is the fact that the mirror rather quickly is modified by the irradiation, whereby the silvery reflecting surface takes on a gradually deepening golden color, with incident loss of reflection effect. This makes necessary rather frequent changes of the mirror. In a busy roentgen therapy department, the interval probably should not exceed eight weeks. An alternative solution for the mirror problem is to use an ordinary glass mirror which can be moved out of the irradiation field prior to therapy. An objection which could be raised against this technique is that the possible failure to remove the mirror from the treatment beam exists. Such reasoning, however, is not valid as it could be applied to almost anything which is subject to human error. The mirror should be large enough to bring into view the entire area intended for treatment rather than a small segment of the peroral field.

More important than the reflecting surface in the periscope is the lighting apparatus. The precision and, thereby, the effectiveness with which one gives the treatment depends in large measure on good lighting. This is of fundamental importance in the treatment of carcinoma of the oral cavity where we have found that precision therapy of the highest order is essential to

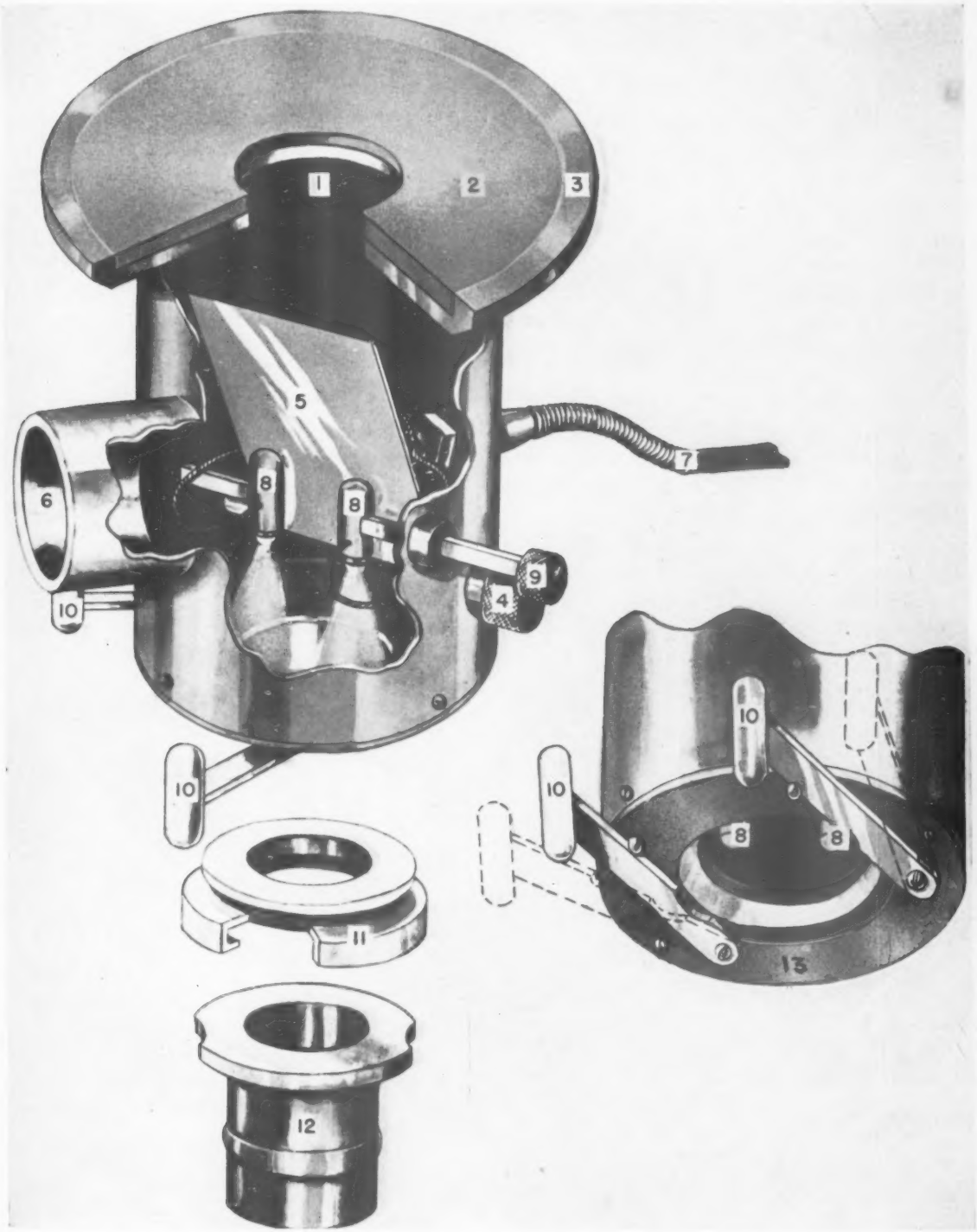

Fig. 1. *1*, columnated opening—upper end of periscope; *2*, lead—4 mm. thick on brass base; *3*, beveled edge—(attaches to adapter); *4*, knurled knob mirror control; *5*, mirror (can be fixed or movable); *6*, viewing aperture; *7*, electrical current connection; *8*, holders for bulbs; *9*, lateral excursion control for lighting; *10*, cylinder adapter release; *11*, cylinder adapter; *12*, master cylinder (target skin distance 36 cm.); *13*, lower end of periscope.

increased salvage rates and reduced morbidity rates.* This is especially true where irradiation and surgical techniques are combined.

Appreciating the need of an improved periscopic device which can be used on all types of therapy apparatus, the author has developed a periscope which is relatively simple, yet ideally suited to perform its task—namely, the proper visualization of the treatment area (see Fig. 1).

The significant improvement of this periscope over present day periscopes is found in a new method of lighting which has proved to be eminently successful. The light bulbs are attached to metal arms (Fig. 1, *9*) which have a 2.2 cm. lateral excursion. This device is of fundamental importance in that it makes possible the adjustment of the position of the lights. The bulbs or lights can be adjusted for the size cylinder to be used and withdrawn from the treatment beam when therapy is under way. The smaller cylinder will be just as well lighted as the larger. The light bulbs are of the type that is used in cystoscopes, and face in the direction of the lesion. Adequate direct lighting is achieved. Glare is eliminated; undesirable heavy shadows do not appear.

The apparatus is attached to the tube head after removal of the ionization chamber. For a correct filtration reading on the control panel, copper of sufficient thickness is added to the periscope to give the same filtration equivalent as that in the ionization chamber. The periscope shown in Figure 1 has a mounting plate which attaches to a Picker 200 kv. (peak) oil head unit.

CONCLUSION

Described is a periscope with adjustable direct lighting. The light position can be easily adjusted to meet the needs of the cylinder size in use. The apparatus is simple, durable, compact and not costly.*

* Material to be published.

* Manufactured by Walter Butterworth, 150 Elm Ave., Philadelphia 11, Pa.

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Committee on Arrangements: Gordon P. McNeer, Chairman, New York, N. Y., Gray H. Twombly, New York, N. Y., Theodore R. Miller, New York, N. Y.

Advisory Committee on X-ray and Radium Protection of the National Committee on Radiation Protection: Edith H. Quimby, New York, N. Y., John E. Wirth, Baltimore, Md.

Exhibit Committee: Robert E. Fricke, Chairman, Rochester, Minn., William Harris, New York, N. Y., Milton Friedman, New York, N. Y.

Thirty-Third Annual Meeting: Atlantic City, N. J., 1951.

EDITORIALS

THE LERICHE SYNDROME

(THROMBOTIC OBLITERATION OF THE AORTIC BIFURCATION)

THROMBOSIS of the bifurcation of the abdominal aorta has been recognized as a distinct anatomico-pathological entity for a long time—indeed, since the middle of the last century. However, it is only recently that the distinguished French surgeon, Leriche, in whose honor the syndrome is named, has given thrombosis of the bifurcation of the aorta the clinical sigficance it actually deserves.

In 1940 Leriche,[2] in reporting some of his cases, stated that "thrombosis due to arteritis of the terminal segment of the aorta above the level of the inferior mesenteric artery is less rare than is generally assumed, but it is not diagnosed and even less operated on." He had operated upon 5 cases in which a correct diagnosis was made preoperatively, and at the time of the operation the diagnosis was confirmed either by sight or by touch. Leriche made it quite clear that in talking about thrombosis due to arteritis he was not discussing embolus since embolic obliteration represents a different expression of the aortic problem, this being an acute condition which may be easy to identify. But the thrombosis of the abdominal aorta due to arteritis is a particular form of thrombosing arteritis. The obliteration produced by thrombosis of the aorta and of the iliac arteries manifests itself gradually and Leriche emphasized that this gradual obliteration produces a characteristic syndrome which comprises five elements: impossibility of a firm erection; extreme fatigability of the lower extremities; global atrophy of the lower limbs; ivory pallor on elevation of the lower extremities; disappearance of the pulse, and oscillations at the level of the legs and thighs.

Sooner or later this progressive thrombosis of the aorta and the iliac arteries leads to grave ischemic phenomena of the lower extremities with gangrene resulting from the secondary peripheral obliterations.

Histopathologic examinations as well as aortographic studies have shown that the obliterating thrombosis of the bifurcation of the aorta usually begins in one of the common iliac arteries, extends across the bifurcation and gradually advances into the common iliac artery of the opposite side, which it may eventually occlude. In this manner, the terminal aorta is transformed into a cul-de-sac and by further apposition the thrombosis spreads upward toward the origin of the inferior mesenteric artery and may reach as high as the orifices of the renal arteries. When the syndrome is fully developed the lumina of both common iliac arteries and aorta are completely obliterated by dense thrombus which is tightly adherent to the thickened walls of the vessels. The limited blood supply of the lower extremities is maintained by a collateral circulation connecting the lumbar arteries (branches of the abdominal aorta) with the circumflex iliac, iliolumbar and epigastric arteries which through a network of pelvic and perineal vessels indirectly establishes communications with the femoral arteries. There may also be an important anastomosis between the visceral arteries, as, for example, between the median colic and left colic arteries, permitting the inferior mesenteric artery to receive blood through the superior mesenteric artery and thus obviate gangrene of the sigmoid colon.

Leriche[7] states that this thrombotic

disease which involves the iliac and the distal portions of the aorta appears to be a disease with a long course, presenting for a long period "symptoms which have no meaning for the physician, unpleasant as they may be for the patient" and that this slowly progressing thrombotic process may be compatible for years with an almost normal life.

Leriche further states that from the scarcity of reports in medical literature thrombotic obliteration of the aortic bifurcation might be assumed to be a relatively rare condition. He, however, is quite sure from an analysis and observation of his cases that its occurrence is not infrequent and that adequate knowledge of the syndrome will help to discover an increasing number of cases which otherwise would remain misunderstood.

Apparently the disease evolves itself in two stages. The first stage, as stated, may extend over a period of ten to twenty years, and during this time the obliteration of the distal portion of the aorta is compensated by the collateral circulation. Among the main clinical features is an intermittent fatigability which is insidious in the beginning but occurs regularly when the patient walks an appreciable distance. Associated with this fatigability may be a continuous sensation of cold in the lower extremities and in about a fourth of the cases there occurs the difficulty in obtaining a firm erection of the penis due to ischemia of the corpora cavernosa, especially when both iliac arteries are affected. Clinical examination of the patient usually reveals marked atrophy of the muscles of both lower extremities but without atrophic changes of the skin or toenails; extremely pronounced pallor which on elevating the limb assumes a peculiar cadaveric appearance, and complete absence of pulsation in all arteries of both lower extremities.

If the disease process is not recognized in its earlier stages there develop symptoms indicative of terminal decompensation. The patient may be unable to walk and suffers severe pain in the legs with cyanosis and edema. There is a rapidly progressive muscular atrophy of both lower extremities and finally atrophic changes make their appearance which may lead rapidly to a painful gangrene with secondary infection often followed by death.

Leriche, in discussing his group of cases, states that one should never diagnose a "neuritis" or a "polyneuritis" of the lower limbs unless one has carefully examined the femoral pulses and the oscillometric curve. Bearing this in mind, he insists that the diagnosis is easy. Indeed, he states that when a patient complains of impotency, or of extreme fatigability of the lower limbs, or of pain in the thighs on exertion, if the physician finds alterations in the peripheral pulses, a provisional diagnosis of thrombotic obliteration of the aortic bifurcation may be made. In practically all of the cases, the clinical data, a shrewd study of the patient's history, and oscillometry will lead to a correct interpretation of the origin of the patient's difficulties.

In addition, the use of aortography as originally developed by Reynaldo dos Santos[1] will add materially toward arriving at a precise diagnosis. It gives, when properly performed, a clear cut picture of the lesions, of their extent, and of the thin net of anastomoses and bypaths which allows the vital and necessary blood supply, even though scanty, to reach the ischemic limbs.

Aortography is a well established and well recognized procedure but perhaps it is not as much used as clinical indications warrant. Since the original publication of dos Santos' communication concerning the visualization of the abdominal aorta, many papers have been written dealing with its use. Fariñas[4] presented an excellent paper at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America in 1944, describing a somewhat different type of technique from that employed by dos Santos. At the annual meeting of the American Roentgen Ray Society in 1946 Wagner, Price and Swenson[6] reported their important work on abdominal arteriography

giving very valuable advice not only concerning the meticulous technique that is necessary but also on the diagnostic application of this type of examination. Up to the time of the publication of that paper abdominal arteriography was performed twenty-six times in their clinic without untoward effects. However, these authors, as have others, called attention to the potential dangers, stressing the fact that this procedure should be employed as a diagnostic adjunct only by a carefully trained personnel after simpler and the usual careful clinical studies have failed to yield sufficient information to reach a diagnostic conclusion.

Leriche, in discussing the use of aortography as an adjunct to the clinical diagnosis of thrombotic obliteration of the aorta, says that if the patient is heavy, or presents signs of diminished cardiac output, or has cyanotic legs with violaceous blurs, the method is to be avoided, because in such cases its performance may lead to the extension of the thrombosis, with fatal results.

That the Leriche syndrome is a fairly frequent manifestation is evidenced by the recurrent reports in the literature. A recent paper on the subject by Mazzei *et al.*[10] reports 6 cases, 5 of which were in the early stage and one in the late stage of the Leriche syndrome. These authors call particular attention to the great assistance which the aortograms gave in establishing the correct diagnosis in all cases as well as the clear cut indications of the degree of obstruction in the aorta and the extent of the collateral circulation. They discuss not only the clinical aspects of their cases but give a detailed account of their procedure in performing aortography and call special attention to the fact that a sensitivity test was performed on all patients a few days before the examination by administering parenterally some organic iodide preparation. In a study of their cases they observed no untoward effect from their procedure. On the contrary, they report that all their patients experienced a subjective and objective improvement for some days after aortography.

Aortography is a valuable procedure which, in the hands of those equipped to do the examination, is apparently without danger in the properly selected cases and is of great assistance in arriving at a proper diagnosis of the Leriche syndrome.

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GEORGE C. JOHNSTON
1872-1950

George Coffin Johnston was born in Lisbon, Ohio, on April 4, 1872. His father was a Presbyterian minister noted as an eloquent preacher as well as a man of strict religious principles. On his mother's side he descended from the pioneer New England "Coffin family" who with others settled Nantucket Island.

At the age of nineteen he entered Washington and Jefferson College to study for the ministry. After two years he changed his mind and enrolled in the West Penn Medical College, then associated with the Western University of Pennsylvania. He graduated in medicine in 1896 and began general practice in the Oakland district of Pittsburgh.

He married Ida Davis in 1899 and their daughter Dorothy was born in 1903.

Dr. Johnston was obliged to give up general practice after a short time, having developed tuberculosis of the lungs. He moved to Colorado because of this illness and returned to Pittsburgh in 1900. Upon his return he became interested in roentgenology and began the practice of that specialty in the same year. In 1902 Dr. Johnston, together with Dr. Russell H. Boggs, was appointed Professor of Roentgenology in his Alma Mater, the West Penn Medical College. In 1908 that school was absorbed by the newly organized University of Pittsburgh and Dr. Boggs and Dr. Johnston became professors in the new school. In 1915 Dr. Boggs retired from the University and Dr. Johnston carried on as professor until he ceased to practice.

In 1913 the writer of this article became associated with Dr. Johnston both in private and hospital practice and this partnership continued until 1930.

In 1917 Dr. Johnston entered the United States Army as a Major in the Medical Corps and conducted a School for the Training of Army Roentgenologists in Pittsburgh until this function was centered entirely at Fort Oglethorpe and the regional schools were abandoned. Major Johnston was then transferred to the Surgeon General's office in Washington where he represented Roentgenology until the end of World War I. He was discharged from the Army in 1919 with the rank of Colonel. Colonel Johnston was very proud of his Army experience and after his retirement from the practice of medicine and removal to a distant state, he used his military rather than his medical title for the rest of his life.

George C. Johnston

After his return to civil life he practiced for only one year when he was obliged to stop work because of a heart ailment. This happened in the autumn and he went to Florida for the winter, but it was his fate never to return to the practice of radiology. As a matter of fact he did not spend more than a few days in Pittsburgh for the rest of his life. In 1930 when it became evident that he would never return to practice, the partnership of Dr. Johnston and Grier was dissolved and he retired from the professorship at the University of Pittsburgh, being succeeded by Dr. Grier.

In Orlando, Florida, Colonel Johnston eventually became active in both business and civic affairs. At one time he was Mayor of the city and about 1930 he acquired an interest in the broadcasting station there. Later he owned and operated this station himself, quite successfully, and to the advantage of the community.

George Johnston joined the American Roentgen Ray Society in 1900, the year the organization was founded. Apparently he was not a charter member as the records say he was *elected* in 1900. In his early years of practice he took a particular interest in roentgen therapy and was known throughout the country for his success in this field. For many years his office attracted many radiologists who were trying to learn more about therapy. He was quite adept in mechanical procedures and our office was filled with home-made gadgets of all sorts, some of which were the basis of permanent improvements in roentgenologic apparatus. He was always very much interested in the affairs of the American Roentgen Ray Society and should be given full credit, together with the other pioneers of that day, for directing this new organization toward the high plane it now occupies. In 1900 there were few doctors doing roentgenologic work. It was done largely by lay people: hospital clerks, the druggist, nuns, nurses, or anybody who knew how to develop a photographic plate. Dr. Johnston was President of the American Roentgen Ray Society in 1909 and from then until his retirement in 1920 was very active through numerous committees in furthering its interests. He was always present at meetings and took part in both scientific and business matters. His ready wit and nimble tongue will be remembered by the older members. He was a life member and enjoys the unique distinction of having been a member for fifty years.

Dr. Johnston died of a coronary attack on April 29, 1950, while visiting a sister in California.

G. W. GRIER, M.D.

KARL M. BONOFF
1892-1949

Dr. Karl Bonoff, born in Minneapolis, Minnesota, February 6, 1892, died on May 10, 1949. Dr. Bonoff was one of the pioneer members of the Radiological Section of the Los Angeles County Medical Association. He was killed by a motorist who ran through a red light at high speed and struck the car in which the Bonoff family was riding. Mrs. Bonoff, though severely injured, has since recovered.

Dr. Bonoff was a member of the American Roentgen Ray Society, the Radiological Society of North America, the American College of Radiology (Fellow), and the American Medical Association, and a diplomate of the American Board of Radiology. He was active in the California Medical Association, the Los Angeles County Medical Association, the Los Angeles County Radiological Society, and the Pacific Roentgen Society. He held at various times appointments as Councilor of the Los Angeles County Medical Association (1937 to 1941); Chairman of the Pacific Roentgen Society (1939); Chairman of the Radiological Section of the California Medical Association (1939); Councilor for the Radiological Society of North America (1947 to 1948). Dr. Bonoff was also a charter member of the Los Angeles Trudeau Society.

Dr. Bonoff was Consulting Radiologist for the Kaspare Cohen Hospital (now Cedars) from 1919 to 1929. He was Staff Member of the Cedars of Lebanon Hospital from 1930 to 1949. Between 1940 and 1947, Dr. Bonoff set up and headed the radiological department of the Mt. Sinai Clinic. From 1920 to 1932 he was Consulting Radiologist for the Duarte Sanitarium (now City of Hope). He was also associated with the French Hospital.

Dr. Bonoff attended the Los Angeles High School and the University of Southern California, where he received the degree of M.D. in 1914. He served his internship and residency at the Los Angeles County General Hospital.

During World War I Dr. Bonoff served in the A.E.F. in France from 1917 to 1919,

Karl M. Bonoff

doing radiology as a First Lieutenant. He was in private practice from 1919 until the time of his death.

Dr. Bonoff is survived by his wife Edna, and his son, Chester P. Bonoff, who was just finishing a residency in radiology at the Los Angeles County General Hospital at the time of his father's death, and who has now taken over the private practice left by Dr. Bonoff.

WILBUR BAILEY, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Jefferson Hotel, St. Louis, Mo., Sept. 26–29, 1950.

AMERICAN RADIUM SOCIETY
Secretary, Dr. J. E. Wirth, U. S. Marine Hospital, Baltimore, Md. Annual meeting: 1951, to be announced.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y., Annual meeting: Palmer House, Chicago, Ill., Dec. 10–15, 1950.

AMERICAN COLLEGE OF RADIOLOGY
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Paul C. Hodges, 950 E. 59th St., Chicago, Ill.

ALABAMA RADIOLOGICAL SOCIETY
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS
Secretary, Dr. R. Lee Foster, 507 Professional Bldg., Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

ARKANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

ATLANTA RADIOLOGICAL SOCIETY
Secretary, D. W. W. Bryan, 490 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

CENTRAL OHIO RADIOLOGICAL SOCIETY
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

CINCINNATI RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Hannan, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. Paul E. RePass, 306 Republic Bldg., Denver 2, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

DALLAS-FORT WORTH ROENTGEN STUDY CLUB
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. W. G. Belanger, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

EAST BAY ROENTGEN SOCIETY
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. F. K. Hurt, Riverside Hospital, Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

GEORGIA RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Pendergrass, Americus, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

GREATER MIAMI RADIOLOGICAL SOCIETY
Secretary, Dr. David Kirsh, 712 duPont Bldg., Miami 32, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

HOUSTON X-RAY CLUB
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St. Houston 4, Texas. Meets fourth Monday each month.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

IOWA X-RAY CLUB
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. Special meetings by announcement.

KANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

KENTUCKY RADIOLOGICAL SOCIETY
Secretary, Dr. W. C. Martin, 321 W. Broadway, Louisville. Meets annually in Louisville on first Saturday in Apr.

KINGS COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

LOS ANGELES RADIOLOGICAL SOCIETY
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

LOUISIANA RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

* Secretaries of societies are requested to send timely information promptly to the Editor

Louisville Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

Maine Radiological Society
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

Michigan Association of Roentgenologists
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

Nebraska Radiological Society
Secretary, Dr. J. E. Downing, 816 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. George Levene, Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday, Harvard Club.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. J. L. Olpp, 49 Ivy Lane, Tenafly, N. J. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

Northern California Radiological Club
Secretary, Dr. C. W. Wauters, 701 High St., Auburn, Calif. Meets at dinner last Monday, every second month, except June, July and August.

Ohio State Radiological Society
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, 21st & Xanthus, Tulsa 4, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. C. T. Jessell, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. G. P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Queens Roentgen Ray Society
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, Sept. to May.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Fred Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

Radiological Section, District of Columbia Medical Society
Secretary, Dr. K. C. Corley, 1835 Eye St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, Jan., March, May, Oct. at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Radiological Society of New Jersey
Secretary, Dr. Peter Gianquinto, 685 High St., Newark, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. A. V. Winchell, 40 Meigs St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Meets Shirley-Savoy Hotel, Denver, Colo., Aug. 17, 18, 19, 1950.

St. Louis Society of Radiologists
Secretary, Dr. H. R. Senturia, Pasteur Medical Building, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Wednesday at dinner.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Carolina X-Ray Society
Secretary, Dr. S. H. Fisher, 107 E. North St., Greenville, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon. 650 Fifth Ave., Fort Worth 4, Texas. Next meeting, Galveston, Texas, January 19 and 20, 1951.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

VIRGINIA RADIOLOGICAL SOCIETY
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

WASHINGTON STATE RADIOLOGICAL SOCIETY
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

WISCONSIN RADIOLOGICAL SOCIETY
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-RAY STUDY CLUB OF SAN FRANCISCO
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets January to July, Lane Hall, Stanford University Hospital, and July to December at San Francisco Hospital.

CUBA, MEXICO AND CENTRAL AMERICA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

SOCIEDAD MEXICANA DE RADIOLOGIA Y FISIOTERAPIA
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

SOCIEDAD RADIOLÓGICA PANAMEÑA
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86 Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

FACULTY OF RADIOLOGISTS
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

SECTION OF RADIOLOGY OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

CANADIAN ASSOCIATION OF RADIOLOGISTS
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

SECTION OF RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

AUSTRALIAN AND NEW ZEALAND ASSOCIATION OF RADIOLOGISTS
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. I. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

SOUTH AMERICA

ASOCIACION ARGENTINA DE RADIOLOGIA
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA
Secretary, Dr. Guido Gotta, Buenos Aires, Argentina. Meetings are held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGÍA, FILIAL DEL LITORAL
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 7:00 P.M., 663 Italia St., Rosario.

SOCIEDADE BRASILEIRA DE RADIOLOGIA MEDICA
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

SOCIEDADE BRASILEIRA DE RADIOTERAPIA
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

SOCIEDAD PERUANA DE RADIOLOGIA
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

SOCIEDAD DE RADIOLOGICA, CANCEROLOGIA Y FISICA MEDICA DEL URUGUAY
Secretary, Dr. Arias Bellini.

CONTINENTAL EUROPE

SOCIÉTÉ BELGE DE RADIOLOGIE
General Secretary, Dr. S. Masy, 111 Avenue des Alliés, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

CESKOSLOVENSKÁ SPOLEČNOST PRO RÖNTGENOLOGII A RADIOLOGII V PRAZE
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

GDANSK SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10.30, X-Ray Dept., Akademia Gdansk.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD.
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 P.M.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

SOCIEDAD ESPANOLA DE RADIOLOGIA Y ELECTROLOGIA
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT (SOCIÉTÉ SUISSE DE RADIOLOGIE)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

SOCIETA ITALIANA DI RADIOLOGIA MEDICA
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

METHOD OF ROENTGEN PELVIMETRY

To the Editor:

In my paper published in the May, 1950, issue of this JOURNAL,* I described a method of pelvimetry which I believed to be original. Following publication, Dr. Paul Cave of Reading, England, advised me that he had been using the same principle for the past ten years, and sent me a reprint of his excellent description of the method, which appeared in the *British Medical Journal.*†

Unfortunately, my work was done without knowledge of this report. In carefully searching the purely radiological literature of the United States and England, I had found no reference to Dr. Cave's paper.

The similarity of the thought independently expressed in Dr. Cave's paper and my own is remarkable. He is entitled to full credit as the originator of the principle which I chose to call "differential divergent distortion." I can only hope that the standardized technique and the nomogram for rapid calculation that I originated will help to make this method more generally useful.

IVAN ISAACS

MAINE RADIOLOGICAL SOCIETY

On June 19, 1950, the radiologists of Maine completed final arrangements for organizing the Maine Radiological Society. A working constitution was adopted and the following permanent officers were elected: *President*, Dr. Forrest B. Ames, Bangor, Maine; *Vice-President*, Dr. Langdon T. Thaxter, Portland, Maine; *Secretary-Treasurer*, Dr. Clark F. Miller, Lewiston, Maine. *Members of the Executive Committee:* Dr. Jack Spencer, Portland, Maine; Dr. Hugh Allan Smith, Bangor, Maine.

UROLOGY AWARD

The American Urological Association offers an annual award of $1,000.00 (first prize of $500.00, second prize $300.00 and third prize $200.00) for essays on the result of some clinical or laboratory research in Urology. Competition shall be limited to urologists who have been in such specific practice for not more than five years and to men in training to become urologists.

The first prize essay will appear on the program of the forthcoming meeting of the American Urological Association, to be held at the Palmer House, Chicago, Illinois, May 21–24, 1951.

For full particulars write the Secretary, Dr. Charles H. de T. Shivers, Boardwalk National Arcade Building, Atlantic City, New Jersey. Essays must be in his hands before February 10, 1951.

Committee on Scientific Research
MILEY B. WESSON, *Chairman*
ANSON L. CLARK
JOHN E. HESLIN

AMERICAN COLLEGE OF RADIOLOGY

At the Twenty-sixth Annual Meeting of the American College of Radiology held in San Francisco, California, on June 25, 1950, Dr. C. Edgar Virden, Kansas City, Missouri, was elected President of the College for 1950–1951. Dr. Earl E. Barth, Chicago, Illinois, was elected Vice-President.

The Members and Fellows elected Dr. Clarence E. Hufford, Toledo, Ohio, and Dr. Charles H. Heacock, Memphis, Tennessee, to four year terms on the Board of Chancellors. Representing the scientific societies on the Board of Chancellors, Dr. John D. Camp, Rochester, Minnesota, was re-elected on the nomination of the Radiological Society of North America, Dr. George W. Grier, Pittsburgh, Pennsylvania, was re-elected on the nomination of the American Roentgen Ray Society, and Dr. Hugh F. Hare, Boston, Massachusetts, was re-elected on the nomination of the American Radium Society.

At the meeting of the new Board of Chancellors following the annual meeting of the College, Dr. John S. Bouslog, Denver, Colorado, was elected Chairman of the Board of Chancellors, and Dr. Warren W. Furey, Chicago, Illinois, was re-elected Treasurer.

* Isaacs, I. Roentgen pelvimetry by differential divergent distortion. AM. J. ROENTGENOL. & RAD. THERAPY. May, 1950, *63*, 669–676.

† Cave, P. Precision method of cephalometry and pelvimetry. *Brit. M. J.*, 1943, *2*, 196–198.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

MANUEL DE RADIODIAGNOSTIC CLINIQUE. Par R. Ledoux-Lebard, Chargé de Cours de Radiologie clinique à la Faculté de Médecine de Paris, Radiologiste des Hôpitaux; et Guy-R. Ledoux-Lebard, Ancien chef de Clinique à la Faculté de Médecine de Paris, Assistant de Radiologie des Hôpitaux. Deuxième édition entièrement refondue. Cloth. Price, 5500 fr. Pp. 1,407, with 2,000 illustrations. Masson et Cie., 120, Boulevard Saint-Germain, Paris 6e, France, 1949.

Ledoux-Lebard has for two generations been a name widely known as that of an authority on all things relative to radiology. He and his assistants have written authoritatively on all phases of diagnostic roentgenology, as well as on roentgenological technique. The book on technique probably ranks highest of all existing textbooks on that subject.

René and Guy-R. Ledoux-Lebard, father and son, have collaborated in the publication of this new edition, completely revised and elaborated until its nearly fourteen hundred pages represent a mine of information, wisely arranged, beautifully illustrated and presented in a straightforward conversational style, without frills, which make it very easy for consultation, even by those with only a moderate knowledge of the French language.

The arrangement of the book is about as one would anticipate in a textbook of this sort. The illustrations are numerous and for the most part clear, although a few have been badly reproduced. The badly reproduced cuts are for the most part of rare cases where it is understandable that the authors did not have much opportunity to select better prints.

The discussions are quite up to the moment. Angiography and cardiography are considered in detail; myelography, ventriculography and encephalography come in for their due quota of attention.

It is impossible in a short review to convey an adequate impression of the total, and yet the simplicity with which the entire subject of diagnostic roentgenology is handled makes for a very attractive book. The authors have attempted to maintain contact with the pioneers in the different fields of diagnostic roentgenology, so that the text is endowed with a certain commendable personality.

JAMES T. CASE, M.D.

CONFRONTATIONS—RADIO-ANATOMO-CLINIQUES. Published under the direction of M. Chiray, R. A. Gutmann, and J. Sénèque. Volume II. Paper. Price, 465 fr. Pp. 67, with 140 illustrations. Paris: G. Doin et Cie., Masson et Cie., 1947; Volume III. Paper. Price, 1000 fr. Pp. 79, with 150 illustrations. Paris: G. Doin et Cie., Masson et Cie., 1949.

These two volumes constitute the second and third of a series of volumes published under the direction of these authors, giving detailed findings from the anatomical, roentgenological and clinical standpoints for a number of selected cases. The illustrations are superb. The type and size page are such as to make reading very easy. A variety of very interesting clinical presentations has been made, including such lesions as fibrocystic disease, dissecting osteochondritis, tabetic arthropathy, sacral plasmocytoma, secondary neoplastic lesions; a large variety of gastrointestinal lesions, mostly cancer and lesions which have to be differentiated from cancer. These are only a few of the numerous presentations in Volume II. In Volume III respiratory infections and gastrointestinal and urinary tract lesions predominate. The first volume of the series included thirty presentations of gastroenterological cases.

JAMES T. CASE, M.D.

SCHILDDRÜSE UND BASEDOW. BEITRÄGE ZUR HISTO-MORPHOLOGIE UND FUNKTION DER SCHILDDRÜSE VERSCHIEDENER FREILEBENDER TIERE. Von Prof. Dr. med. Wilhelm Eickhoff, Rheine/Westfalen. Cardboard. Price, DM 10.80. Pp. 127, with 42 illustrations. Stuttgart: Georg Thieme, 1943.

This is a lengthy report on experimental studies, performed mainly on wild rabbits. Each month during one year ten wild rabbits were either shot or caught by ferrets and killed immediately after capture. Microscopic examination of the thyroid showed no significant sea-

sonal change. This was surprising in view of the generally held opinion that the thyroid shows signs of activity—loss of colloid and epithelial hyperplasia—during the winter months. Over 50 per cent of the animals showed signs of thyroid activity during the whole year, with the exception of the animals caught in August. In another series of studies wild rabbits were caught by ferrets and then kept alive in large cages. While in captivity, the animals were scared by ferret, dogs and by the author. All these rabbits died within a few hours to several days, having shown tachycardia, rapid respiration, restlessness and weight loss. The thyroid showed in every case complete loss of colloid; those thyroids, which were examined after the first day from capture, showed also epithelial changes typical for overactivity. There was no other pathology except for inanition. The author believes that the cause of the symptoms and of death is acute hyperthyroidism. The result of therapy appears to favor this diagnosis, since after total thyroidectomy and after treatment with methyl thiouracil the animals were more quiet than the controls, did not lose as much weight and could be kept alive at least three times as long. In the author's opinion, the hyperthyroidism in the rabbits is the result of fear, which somehow leads to the release of large amounts of thyrotropic hormone. The work was done between 1944 and 1948 under very difficult conditions, e.g. some of the thyroidectomized rabbits were stolen after several weeks, so that the length of their survival made possible by the operation could not be determined.

PAUL WERMER, M.D.

THE FUNDAMENTALS OF PULMONARY TUBERCULOSIS AND ITS COMPLICATIONS. For the Student, the Teacher, and the Practicing Physician. Sponsored by the American College of Chest Physicians. Edited by Edward W. Hayes, M.D. Cloth. Price, $9.50. Pp. 480, with 182 illustrations and 2 full-page 4-color plates. Springfield, Illinois: Charles C Thomas, 1949.

It is impossible to do justice to this book in a brief review because of its comprehensive character and the numerous subjects considered. It is a compilation by twenty-seven authors on the history, causation, diagnosis, control and treatment of pulmonary tuberculosis. A list of the subjects covered in the twenty-six chapters would make its study appear a formidable task but the material is so well chosen for its practical importance and is so well presented that the book can be read by any student or medical practitioner with interest and profit.

The purpose of the authors is to make available to everyone called upon to treat the tuberculous patient all essential knowledge, not only for diagnosis and treatment of the individual case but for the control and final eradication of the disease. Although each chapter is brief and concise the entire work may be considered authoritative. The subjects are not dealt with from the standpoint of the specialists in various fields but with the object of acquainting the general physician with the essential facts of the bacteriology, pathology, diagnosis and management of the disease and to help him to orient himself on the whole subject. The chapter on radiology is written with the above objects in view and is in no sense an attempt to describe the roentgenological findings in pulmonary tuberculosis. The radiologist, however, who looks upon himself as a broad minded physician interested in every aspect of the diagnosis and control of tuberculosis will find this book a helpful aid in keeping him abreast of all that is now known about this disease.

The comprehensive nature of the work may be judged by consideration of only a few of the subjects presented, for example: Primary Tuberculosis; Bacteriology, Infection and Pathology; Reinfection Pulmonary Tuberculosis (Classification, Diagnosis, Differential Diagnosis, Treatment); Anti-bacterial Therapy; Role of the Bronchial Tree in Pathogenesis; Simpler Forms of Mechanical Therapy; Major Surgical Procedures; Tuberculosis Control; and many others.

The book will not only repay a general reading but will be valuable as a reference work for a long time to come.

A. C. CHRISTIE, M.D.

INTESTINAL INTUBATION. By Meyer O. Cantor, M.D., M.S., F.A.C.S., Assistant Attending Surgeon, Grace Hospital; Formerly, Senior Attending Surgeon, Deaconess Hospital, Detroit, Michigan. Cloth. Price, $7.50. Pp. 333, with 147 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1949.

This book covers in considerable detail the subject of gastrointestinal intubation. The history of intubation is traced from the passage of

the stalk of a leek into the stomach in the sixteenth century to the present use of the long intestinal tubes which can be passed completely through the intestinal tract.

Gastrointestinal anatomy and physiology as related to intubation are discussed in separate chapters, with specific directions for dealing with difficulties which may be encountered because of variations in anatomy, either develmental or acquired, and physiological disturbances such as spasm at the sphincter, atony, and edema of intestinal wall.

The principles, indications, advantages and disadvantages of the various types of both long and short gastrointestinal tubes are presented, with particular emphasis on the advantages of the single lumen Cantor tube. This is a relatively large lumen tube, which is led by a mercury-filled balloon, as opposed to the necessarily smaller lumen in the double lumen Miller-Abbott or Johnston tubes, which are propelled by the effect of intestinal peristalsis on an air-filled balloon attached to the distal end of the tube. In the Cantor tube the quantity of mercury used varies from 2 to 10 cubic centimeters, according to age and size of the patient and the physical condition. In general, atony and sphincteric spasm seem to be indications for the use of larger quantities of mercury, but the larger quantities require ambulation of the patient to utilize the advantage of the added weight. No comments are made about dangers or contraindications to the increased amount of mercury.

One chapter deals with the indications for passage of the tube into the colon, advocating its use in the right colon, but admitting that it is rarely helpful in lesions of the left colon where the content becomes solid.

The chapters on errors and safeguards and nursing care of the patient contain excellent advice and warrant attention by anyone who undertakes the use of the intestinal tubes. There is also a summary of methods of suction which can be used with any of the tubes. The information which the roentgenologist can offer both in regard to tube management and the diagnosis of the cause of the distention is discussed briefly in a chapter entitled "The Role of the Roentgenologist."

A chapter on intubation in infancy and childhood gives data on the anatomy of the upper gastrointestinal tract in the young which should be useful in intubating these patients. The figures on the length of the esophagus and stomach are not very closely correlated with age and size of the patient.

Lastly are reported a series of experiments which reveal that the balloons of the tubes may become overdistended due to permeation by various intestinal gases. In the double lumen tube this would occur only if the lumen to the balloon were obstructed, as by a knot in the tube. In the Cantor tube the author recommends a method of tying the balloon to the tube which would obviate this possibility. Although this is a theoretical hazard, no instance is recorded of its having caused trouble.

The book should be useful reading for anyone using intestinal intubation. There is considerable repetition of the admonitions to the user of gastrointestinal tubes, but these will not go amiss. The author feels that the Cantor tube eliminates the majority of difficulties inherent in the other types of long intestinal tubes. Although he mentions that mercury may be used with the air-filled balloon of the Miller-Abbott or Johnston tube, his comments do not suggest that he has had much experience with this combination.

Lois Cowan Collins, M.D.

Bone and Joint Radiology. By Emerik Markovits, M.D., formerly, Scientific Collaborator of the Central Radiologic Institute of the General Hospital (Holzknecht-Institute), Vienna; Head of the Radiologic Department of Elizabeth Hospital of the City of Budapest; etc. Cloth. Price, $20.00. Pp. 446, with 616 illustrations. New York: The Macmillan Company, 1949.

Emerik Markovits, formerly a distinguished European radiologist who is now in this country, has called upon his twenty-five years of experience in the field to bring forth a useful volume dealing with the vast subject of bone and joint radiology.

The book, which is attractively bound and printed on good quality paper in relatively small but easily readable type, contains a foreword by Professor James T. Case and two main sections. *Part One* consists of a *general section* in which various bone and joint diseases of roentgenologic interest are described, and *Part Two* is made up of a *regional section* in which specific entities peculiar to various anatomic localities are elaborated. This arrangement has necessarily resulted in a certain amount of repeti-

tion, but the author obviously has made a serious attempt to keep this mildly objectionable feature to a minimum.

The first subsection of *Part One* dealing with the anatomy, physiology and radiologic anatomy of bones and joints constitutes perhaps the most outstanding portion of the book. In but four brief chapters the author has documented in a clear, succinct manner important fundamentals of the basic sciences so essential for acquiring more than a superficial understanding of the roentgenologic features of the diseases subsequently described.

Individual descriptions of various bone and joint disorders are brief, stylized and, in many instances, incomplete so that the volume cannot qualify as an all-inclusive, comprehensive text. On the other hand, the unique amplified outline form as well as the multiplicity of diagnostic and differential diagnostic tables employed by Dr. Markovits lend themselves to an orderly, readily accessible arrangement of subject material which perhaps could not otherwise have been achieved.

Illustrative roentgenograms, so important in a book of this sort, can be rated only as fair despite the fact that some have been retouched, and many have been reproduced as positives, presumably in an attempt to preserve minute roentgenographic detail. Unfortunately, this policy has not been followed throughout the book so that the resulting lack of uniformity is immediately noticeable and will undoubtedly prove objectionable to some readers. Numerous simple line drawings supplement the halftone reproductions of roentgenograms, and in most instances, these are very effective in their purpose.

Practitioners, teachers and residents in both radiology and orthopedics should find this book a valuable, useful addition to their libraries.

John F. Holt, M.D.

Morgagni's Syndrome—Hyperostosis frontalis interna, Virilismus, Obesitas. By Folke Henschen, M.D., Emeritus Professor of Pathology at the Caroline Institute, Stockholm, Sweden. Cloth. Price 30/-net. Pp. 172, with numerous illustrations and tables. Oliver and Boyd, Tweeddale Court, Edinburgh, Great Britain, 1949.

This fairly extensive monograph is a discussion of a disease entity which the author has named Morgagni's syndrome, consisting of internal hyperostosis of the frontal bone, virilism, and obesity. The literature pertaining to this subject is reviewed in detail and correlated with the author's material, which is a series of consecutive autopsies of one thousand women. One thousand male skulls are studied as controls.

In addition to careful exposition of the gross and microscopic features of the disease, there is a detailed discussion of the relationship between this and other allied endocrine disturbances. No roentgenograms are included, although frontoparietal and generalized hyperostosis is differentiated from that of the internal table of the frontal bone.

The material is covered very thoroughly, and is displayed by means of many diagrams, tables, and charts. Division of the text into short sections aids in a more rapid grasp of the author's meaning. This volume should be of considerable interest to endocrinologists and pathologists. It would aid any radiologist in interpretation of the possible significance of changes in the frontal bone.

E. F. Lang, M.D.

Elementi di Anatomia Stratigrafica dello Scheletro. By Enzo Bullo, Aiuto e Docente dell'Istituto di Radiologia dell'Università di Milano; and Roberto D'Alò, Assistente Volontario dell'Istituto di Radiologia dell'Università di Milano. Cardboard. Price, L. 3500. Pp. 179, with 89 illustrations. Milano: Casa Editrice Ambrosiana, 1949.

In the preface of this book, Professor Perussia states that whenever a new method appears the general tendency is to apply it first to pathological cases, to test its value in a practical way. Often the study of the normal, which is so important in recognizing disease, is delayed until a more sober appreciation of the method is made.

In the last few years body section roentgenography has been the object of considerable interest on the part of European radiologists, and some very valuable contributions have appeared in England, France, and Italy. The present book is an atlas of normal anatomy from the stratigraphic standpoint and is an excellent description of that normal anatomy which, so far, had been only sketchily covered.

The 89 plates are of natural size, beautifully printed, and accompanied by schematic drawings minutely labeled for their anatomical de-

tail. The body section roentgenograms are excellent, and the authors have been able to show anatomical structure which the reviewer had not previously seen. Of particular interest are the body section roentgenograms of the skull, of the cervical spine, and those of the sacroiliac, sternum, and of the joints of the extremities. In the opinion of the reviewer, the authors have made a very significant contribution, and their book should be in the library of all those interested in body section roentgenography.

Cesare Gianturco, M.D.

Handbook of Materia Medica, Toxicology, and Pharmacology. For Students and Practitioners of Medicine. By Forrest Ramon Davison, B.A., M.Sc., PhD., M.B., Consultant and Toxicologist, Minneapolis; Formerly Assistant Professor of Pharmacology in the School of Medicine, University of Arkansas; etc. Fourth edition. Cloth. Price, $8.50. Pp. 730, with 35 illustrations. St. Louis: C. V. Mosby Company, 1949.

The chief purpose of this compendium of moderate size is to make available information concerning drugs which will be useful to medical students and practicing physicians. It includes concise statements dealing with pharmacology, materia medica, prescription writing, toxicology and the clinical application of all useful drugs employed in medicine, including at least some reference to practically all of the preparations more recently introduced.

The material presented appears to be authentic, well organized, and comprehensive in scope, although the information given from the clinical standpoint is somewhat sketchy. On the other hand, it can be said that for quick reference and as an introduction to the subject of the use of drugs in medicine, this publication is valuable for the large amount of information which it contains. The sections on diuretics and digitalis are especially well written. A distinct addition to the book is the brief but well selected bibliography which follows each section.

Criticisms are that comments on the clinical features of drug therapy are less useful than the information relating to pharmacology and the other divisions of the book. The index is not especially well arranged. For example, one finds thiouracil listed only under the heading of thyroidectomy, and nitroglycerine is given only as glyceryl trinitrate. Reference is made to "thyroid extract" when there is no such drug used in medicine, at least at present in this country. The paper used in the volume and the charts are excellent, but the print is too fine for some readers. The latter, however, has the advantage of presenting a great amount of material in a comparatively small space.

In general, this is a commendable publication which contains a large amount of condensed information bearing on the action and use of drugs as therapeutic agents, as well as comments on prescription writing and toxicology. It is to be recommended to medical students and practitioners, especially as a handy volume for ready reference from which authentic information can be easily obtained.

Cyrus C. Sturgis, M.D.

Vol. 64, No. 3

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

INDEX TO ABSTRACTS

ROENTGEN DIAGNOSIS

Head

Gotten, N., and Hawkes, C. D.: Radiology in neurosurgical conditions in childhood 513

Bull, J. W. D.: Review of cerebral angiography 513

Friedman, A. P., *et al.:* Arteriographic study of effect of drugs on intracranial vessels in patients with chronic headache 514

Chusid, J. G., Robinson, F., and Margules-Lavergne, M. P.: Transient hemiplegia associated with cerebral angiography (diodrast) 515

Chusid, J. G., de Gutiérrez-Mahoney, C. G., and Chaffee, J. S.: Agenesis of the corpus callosum 515

Sutton, D.: Radiological diagnosis of lipoma of the corpus callosum 516

Norlén, G.: Arteriovenous aneurysms of the brain 516

Boldrey, E., and Miller, E. R.: Arteriovenous fistula (aneurysm) of the great cerebral vein (of Galen) and the circle of Willis 517

Barden, R. P., and Lewey, F. H.: Metastasizing cerebellar tumors 517

Gordy, P. D., Peet, M. M., and Kahn, E. A., Surgery of the craniopharyngiomas 518

Brussell, I. J.: Temporomandibular joint diseases 518

Bachi, S.: On a case of carcinoma of the thyroid of the base of the tongue 519

Neck and Chest

Estes, A. C., and Phillips, C.: Papilloma of lacteal duct 519

Press, P.: Comparative study of the results of examinations of the population at large with the results of examinations of tuberculosis contact cases in the detection of pulmonary tuberculosis 520

Paulson, D. L., and Shaw, R. R.: Chronic atelectasis and pneumonitis of the middle lobe 520

Hodson, C. J.: Pulmonary oedema and the "batswing" shadow 521

Cames, O. J., and Cesanelli, A.: Diagnosis and treatment of pulmonary cancer 521

Lampe, I., and Zatzkin, H.: Pulmonary metastases of pseudo-adenomatous basal-cell carcinoma (mucous and salivary gland tumor) 522

Hernández Gonzalo, P., *et al.:* Cytologic study of cancer of the lung by means of bronchial secretions 522

Stockler, A. L., Pereira, L. R., and de Mello, R. F.: Giant intrathoracic fibroma 522

Shipman, S. J., Stephens, H. B., and Binkley, F. M.: Pulmonary alveolar adenomatosis 523

Maier, H. C.: Intrathoracic pheochromocytoma with hypertension 523

Eggimann, P., and Woltz, Blanche: Multiple adenoleiomyomas of both lungs 524

Slavin, P.: Diffuse pulmonary granulomatosis in young women following exposure to beryllium compounds in the manufacture of radio tubes 524

Falk, M. S., and Newcomer, V. D.: Loeffler's syndrome 524

Heacock, C. H.: Pneumonia in children following the ingestion of petroleum products 525

Gelfand, M.: Paraffin pneumonia 525

Hartz, A. S.: Diagnosis of pneumonia preceding tuberculosis 525

Meade, R. H., and Blades, B. B.: Surgical treatment of recurrent and chronic spontaneous pneumothorax of nontuberculous origin 526

Yannitelli, S. A., *et al.:* Fatal tension pneumothorax resulting from diaphragmatic rupture in a patient receiving pneumoperitoneum 526

Bogoch, A., and Walker, J. E.: Diagnosis of pulmonary emphysema 527

Goldstein, P.: Fatal interstitial and mediastinal emphysema following accidental needle perforations of the trachea during jugular venipuncture 527

Vieten, H.: Directed bronchography with water soluble contrast media 528

Fleischner, F. G.: Pathogenesis of bronchiectasis 528

de Moraes, C. C.: Contribution to the study of bronchiectases 528

BISSOLINO, G.: Free coagula within extrapleural pneumothorax cavity 529
MARKS, J. H., SOSMAN, M. C., and SCHLESINGER, M. J.: Massive calcification in infarcted myocardium 529
FREEMAN, N. E., *et al.*: Valsalva maneuver .. 530
ARENDT, J., and CARDON, L.: Diagnosis of intra-auricular thrombosis in the living .. 530
JANKER, R.: X-ray cinematography in congenital heart-disease 530
HELLERSTEIN, H. K., and SANTIAGO-STEVENSON, D.: Atrophy of the heart 530
SOSSAI, M.: Differential diagnosis between exudative pericarditis and cardiac dilatation 531
VAN BUCHEM, F. S. P., VAN VERMESKERKEN, J. L., and ORIE, N. G. M.: Transposition of the aorta (Taussig's syndrome) 531
APLEY, J.: Congenital anomalies of the aortic arch and its branches 531
ELKELES, A.: Calcification of ascending aorta as a diagnostic sign of syphilitic aortitis . 532
SMITHAM, J. H.: Coarctation of the aorta ... 532
GROSS, R. E.: Coarctation of the aorta 533
WEISE, H.: Contribution to the roentgen diagnosis of multiple aneurysms of the pulmonary arteries 533
OSLER, A. A., HOPKINS, W. A., and LEIGH, T. F.: Role of angiocardiography in mediastinal and paramediastinal lesions ... 534
PEREIRAS, R., and CASTELLANOS, A.: Retrograde aortography 534
OLIM, C. B.: Coarctation of the aorta at the level of the diaphragm 534
SCHLICHTER, J., and HARRIS, R.: Vascularization of the aorta. II. Comparative study of the aortic vascularization of several species in health and disease 534
NEMOURS-AUGUSTE, S.: Lower end of the normal esophagus 535
RENNIE, J. B., LAND, F. T., and PARK, S. D. S.: Short oesophagus 536
LYNCH, J. P.: Spontaneous perforation of the esophagus 536
CLIFFTON, E. E.: Spontaneous rupture of the esophagus 536
SCHEIN, C. J., JUDSON, G. L., and HEMPHILL, A. C.: Gastropericardial fistula following transthoracic esophagectomy 537
COTTET, P.: Exceptional tumors of the esophagus 537

Abdomen

DERIU, G.: Pharmacodynamic test with atropine in the gastroduodenal roentgen diagnosis 538
SAWYER, P. N., RHOADES, J. E., and PANZER, RUTH: Evaluation of electrogastrography in diagnosis of gastric cancer 539
MADDOCK, W. G., BELL, J. L., and TREMAINE, M. J.: Gastro-intestinal gas 539
FELDMAN, M.: Isolated subhepatic gas-pocket following punctiform perforation as a complication of duodenal ulcer 540
DOMÍNGUEZ QUESADA, S.: Intestinal intubation with the Harris tube 540
CAFFARATTI, E.: Roentgenological and surgical reports in ulcers of the duodenal bulb . 541
WARTHIN, T. A., WARREN, R., and WISSING, E. G.: Combined medical and surgical management of upper gastrointestinal hemorrhage 541
MASON, S. C., and POLLARD, H. M.: Peptic ulcer following splanchnicectomy 542
HEALY, M. J., JR., and SAUER, P. K.: Some limitations of vagotomy in the treatment of peptic ulcer 542
DRAGSTEDT, L. R., CAMP, E. H., and FRITZ, J. M.: Recurrence of gastric ulcer after complete vagotomy 542
WARMOES, F.: Deforming antritis secondary to ulcer about the incisura angularis of the lesser curvature 543
ALBOT, G., and MAGNIER, F.: Fibromuscular atresia of the prepyloric antrum and its pathological explanation 543
DALLA BERNARDINA, L.: Study of the normal and operated stomach with a very warm opaque meal 543
ZINNINGER, M. M., and COLLINS, W. T.: Extension of carcinoma of the stomach into the duodenum and esophagus 544
WALTHER, O.: Contribution to the roentgen visualization of palpable tumors of the gastrointestinal tract in the region of the small pelvis 544
DOLL, R.: Perforated carcinoma of the stomach simulating perforated gastric ulcer . 544
STORCH, C., REDNER, B., and TURIN, R. D.: Small bowel obstruction in infancy and childhood 545
GLOVER, D. M., and BARRY, F. McA.: Intestinal obstruction in the newborn 545
CAMP, R., and ROBERTS, M. H.: Multiple calcareous deposits in the intestinal tract of the newborn 546
HEFKE, H. W.: Reliability of roentgen examination in hypertrophic pyloric stenosis in infants 546
SILVERMAN, F. N., and CAFFEY, J.: Congenital obstructions of the alimentary tract in infants and children 547
BJERKELUND, C. J.: Symptomatic sprue 547
HENDRIX, J. P., *et al.*: Whipple's intestinal lipodystrophy 547
DEUCHER, W. G.: On the variability of the mucosa of the small bowel 548
JONSSON, S. O.: Carcinoids of the small intestine and the stomach 549

Smets, W., and Danis, A.: Recurrence in regional ileitis (Crohn) 549
Svartz, Nanna, and Ernberg, T.: Cancer coli in cases of colitis ulcerosa 549
Gentile, W., and Levy, S.: Intestinal obstruction due to lesions of the distal colon 550
Pryde, A. W.: Multiple venous thrombosis and visceral carcinoma 550
Johnson, C. C., and Baggenstoss, A. H.: Mesenteric vascular occlusion. II. Study of 60 cases of occlusion of arteries, and of 12 cases of occlusion of both arteries and veins 550
Orlandini, I.: Anatomo-roentgenographic studies of intra- and extra-hepatic biliary ducts in the aged 550
van Wien, A., Desneux, J.-J., and Van Geertruyden, J.: Roentgenological and manometric exploration of the biliary tracts in surgery 551
Galizzi, J.: Cholelithiasis associated with peptic ulcer 551
Congiu, A.: Direct roentgen signs of hydatid cysts of the liver 551
Vasconcelos, E., and Sadek, H. M.: Annular pancreas producing duodenal stenosis 551
Scott, J. V.: Pancreatic cyst 552
Lustok, M. J., and Baum, G. L.: Calcified splenic cyst 553

Gynecology and Obstetrics

Moir, J. C.: Use of radiographs in assessing disproportion 553

Skeletal System

Harnasch, H.: Acro-osteolysis, a new clinical entity 553

RADIOISOTOPES

Griffin, M. A., Jr., Goland, P. P., and Chamberlain, R. H.: Localization of radioactive materials in the phantom brain 554

MISCELLANEOUS

Rose, J. E.: Remote-controlled radium emanation plant and automatic measuring apparatus for gold implants 555
Theismann, H.: Do ultrasonic waves increase the biologic effect of roentgen rays? 556
Epstein, B. S., Cohen, H. L., and Natelson, S.: New series of radiopaque compounds. II. Further notes on the cholecystographic uses of certain iodinated hydroxyphenyl fatty acids 556
Ellinger, F., and Barnett, J. C.: Further studies on the influence of dose fractionation on the lethal x-ray effect produced by total body irradiation in mice 556
Goldfeder, Anna: Further studies on the relation between radiation effects, cell viability, and induced resistance to malignant growth. VI. Anomalous radiosensitivities of analogous mouse mammary adenocarcinomas 557
Marshall, A. G.: Effect of tetra-ethyl ammonium bromide on the renal pelvis and ureter 557
Cozza, F.: Reparative osteogenesis of fracture in animals with hypoparathyroidism treated with vitamin D_2 557

ROENTGEN DIAGNOSIS

HEAD

Gotten, Nicholas, and Hawkes, C. D. Radiology in neurosurgical conditions in childhood. *Radiology*, Dec., 1949, *53*, 798–817.

This article gives a comprehensive review of practically all neurosurgical conditions in childhood in which radiology plays a part. The diseases are divided into congenital anomalies and acquired conditions. The role of encephalography in convulsions is adequately discussed and a plea is made for wider use of this procedure in an attempt to establish an etiology for a large per cent of the cases of convulsive seizures. The value of air studies is demonstrated in instances of cystic degeneration, obstructive hydrocephalus, and benign and malignant tumors. Cerebral arteriograms may be used as a complement to air studies when a vascular lesion is suspected.—*C. A. Stevenson, M.D.*

Bull, James W. D. A review of cerebral angiography. *Proc. Roy. Soc. Med.*, Nov., 1949, *62*, 880–890.

A brief history of cerebral angiography introduces this paper.

Safety. The safety of cerebral angiography compares favorably with that of ventriculography and encephalography. Of the author's 500-odd cases, 3 patients died within two days. Arteriography was not proved to be the cause in any of the three deaths.

Occasionally a slight pyrexia is seen for two or three days following examination, associated with a very sore neck. This is probably due to

some saline or contrast material having entered the carotid sheath and to the small hematoma which sometimes develops.

Premedication and Anesthesia. Food and drink are withheld for four hours prior to the procedure. Local anesthesia is used routinely. General anesthesia is used in children under fifteen years and in uncooperative patients.

Technique. Percutaneous puncture of the common carotid artery is done. Normal saline is injected until the roentgenograms are ready to be taken. Ten cubic centimeters of contrast substance are injected and three films taken at two second intervals. Lateral views are usually taken first then the tube shifted and the procedure repeated for the anteroposterior views. Stereo views may be made if desired, but the author stresses that stereo views cannot be substituted for views in two right-angle planes. Saline is injected again until the films are seen and it is decided if further views are necessary. The complete examination takes fifteen to twenty minutes.

The Scope of Cerebral Angiography. The indications for cerebral angiography are: (1) subarachnoid hemorrhage; (2) arterial occlusion; (3) craniocerebral injury; (4) sequelae of trauma; (5) non-traumatic intracranial expanding lesions.

1. Subarachnoid hemorrhage is always an indication for angiography. Aneurysms are the commonest cause of subarachnoid hemorrhage. Bilateral angiograms may sometimes be necessary for localization. A negative angiogram does not necessarily exclude an aneurysm. Occasionally a patient with a history of subarachnoid hemorrhage will show an angioma and not an aneurysm on roentgen examination. A bleeding tumor may also cause a subarachnoid hemorrhage.

2. Arterial occlusion: Carotid thrombosis is not so rare as is generally supposed. The possibility should be considered in any obscure case of hemiplegia. The sites of election are: (a) about 2.5 cm. distal to the bifurcation of the common carotid artery; (b) adjacent to the anterior clinoid process where the internal carotid pierces the dura. The condition is often seen in younger people.

3. Craniocerebral injury: Angiography has been little used in Britain in cases of acute head injury.

4. Sequelae of trauma: A frontal view is essential for the diagnosis of chronic subdural hematoma. It gives a pathognomonic picture: the middle cerebral vessels are seen to be pressed inward from the inner table of the skull. Arteriovenous fistula at the cavernous sinus is a rare sequela of trauma.

5. Non-traumatic intracranial expanding lesions: Angiography is now recognized as a very valuable aid in tumor diagnosis. Certain tumors have characteristic vascular patterns while others have no intrinsic vascular pattern but manifest themselves by displacing the cerebral vessels. Thus angiography aids in the diagnosis of size, shape, position, and pathology of a tumor.

Angiography is valuable in the localization of subfrontal, parietal, occipital and temporal lobe tumors. In a series of 1,500 angiographic examinations 24 parasagittal frontal tumors were encountered; 13 of these were diagnosed angiographically. Central, deep-seated, supra- and para-sellar lesions are not satisfactorily diagnosed by angiography.

Angiographic Diagnosis of Pathology:

1. Meningiomas: Many of these tumors fill with contrast medium in the arterial phase. Often there is a lag for as long as twelve seconds before the tumor empties. Normally the substance has left the brain in five seconds. Very occasionally malignant gliomas show this lag.

2. Malignant gliomas: A large portion of these tumors are very vascular. Classically many small abnormal vessels having the appearance of minute arteriovenous aneurysms are seen. These vessels are sometimes best seen on the phlebogram. Certain meningiomas may simulate gliomas very closely angiographically.

3. Metastases: Small arteriovenous aneurysms similar to those seen in malignant gliomas may be present. Usually the periphery of a metastatic tumor is better outlined than that of a glioma. Multiple tumors are almost certainly metastatic.

4. Certain expanding lesions such as abscesses, granulomas and benign gliomas (astrocytoma, oligodendroglioma) may manifest themselves by vessel displacement.—*D. R. Bernhardt, M.D.*

FRIEDMAN, ARNOLD P., FEIRING, EMANUEL, DAVIDOFF, LEO, and MERRITT, H. HOUSTON. Arteriographic study of effect of drugs on intracranial vessels in patients with chronic headache. *Arch. Neurol. & Psychiat.*, Dec., 1949, *62*, 818–821.

Since it is believed that certain types of headaches are caused by aberrations in the caliber of the intracranial blood vessels, the authors felt that arteriography might be utilized for the purpose of demonstrating roentgenographically variations in the size of the intracranial vessels. This possibility was tested in 8 patients. Four patients were given histamine intravenously in doses of 0.1 mg. of histamine base. The other 4 patients were given ergotamine tartrate in doses of 0.5 mg. intravenously. After the administration of the drug to be tested two arteriograms were obtained. Of the 4 patients receiving histamine, 2 showed rather pronounced dilatation of the blood vessels after the administration of the drug, while 2 showed no significant changes. Of the 4 patients receiving ergotamine tartrate 2 showed what appeared to be a significant decrease in the size of the blood vessels, while 2 revealed no change. These preliminary observations are insufficient to permit statistical analysis of the effects of the drugs tested, but they do suggest that the technique of angiography may be applicable to the study of the problem of headache and the action of therapeutic agents of the intracranial blood vessels.—*K. K. Latteier, M.D.*

Chusid, J. G., Robinson, Franklin, and Margules-Lavergne, M. P. Transient hemiplegia associated with cerebral angiography (diodrast). *J. Neurosurg.*, Nov., 1949, *6*, 466–474.

Recently, the authors have observed the occurrence of transient hemiplegia in 2 patients as an immediate complication of diodrast cerebral angiography. A review of the literature failed to disclose reports of such transitory hemiplegic phenomena with the use of diodrast in concentration of 35 per cent. These cases are presented, therefore, together with a brief résumé of the pharmacological action of diodrast and the clinical experience of others with its use.

The cases presented followed similar patterns of reaction with flaccid hemiplegia occurring almost immediately after injection of 20 cc. of 35 per cent diodrast. Both patients received similar injections immediately preceding this one with no untoward effect. In both cases motor function of the extremities returned within a few hours and no clinical residue was apparent after a few days. The patients had negative ocular tests for diodrast sensitivity and these patients underwent subsequent angiographic study without incident.

The condition is presumed to be due to cerebral vascular arterial spasm and the patients were treated with tetraethylammonium chloride. This drug was used to produce temporary autonomic blockade in the hope of influencing what was thought to be vasospasm. According to the literature, the quantities of 35 per cent diodrast used, 14 and 17.5 gm., do not seem inordinately large. Since general anesthesia with endotracheal intubation is used in many clinics to perform cerebral angiography it is possible that the depth of anesthesia depresses vasospastic reflex activity and inhibits the onset of hemiplegia. Further, it is perhaps possible that transitory cerebrovascular spasm may occur but its clinical expression be masked during the period of recovery from anesthesia.—*K. K. Latteier, M.D.*

Chusid, J. G., de Gutiérrez-Mahoney, C. G., and Chaffee, J. S. Agenesis of the corpus callosum. *Arch. Neurol. & Psychiat.*, Dec., 1949, *62*, 840–846.

A twenty-two year old male suddenly developed convulsions and frontal headache. There had been retarded mental development and some weakness of the extremities of the right side since childhood. Neurological examination showed hyperactive reflexes in the right upper extremity and the presence of bilateral extensor plantar reflexes. There was slight hypoesthesia in the right half of the body. The pneumoencephalogram and ventriculogram revealed wide separation of the lateral ventricles and considerable dilatation of the left ventricle and of the posterior portion of the right ventricle. These roentgenographic findings fulfill several of the criteria proposed by Davidoff and Dyke for the diagnosis of agenesis of the corpus callosum. Electroencephalographic studies in general were not grossly abnormal, and were consistent with the diagnosis of agenesis of the corpus callosum. An unusual finding was the appearance of periods of slow, high amplitude waves over the left parieto occipital area, while the comparable zone on the right showed normal alpha wave activity.

Craniotomy disclosed a fairly large porencephalic cyst in the frontoparietal region of the left cerebrum. The corpus callosum was represented by a paper-thin membrane and no septum pellucidum was seen. Apparently the

porencephaly was responsible for the focal changes over the left parieto-occipital region in the electroencephalogram. The strong possibility of associated defects or anomalies of the brain in patients with agenesis or hypoplasia of the corpus callosum must temper interpretation of encephalograms and electroencephalograms in such cases. This case also illustrates that the corpus callosum is not the sole or primary structure which integrates interhemispheric electrical activity and is not necessary for the production of a normal electroencephalogram.—*Harold Fulton, M.D.*

SUTTON, DAVID. The radiological diagnosis of lipoma of the corpus callosum. *Brit. J. Radiol.*, Sept., 1949, *22*, 534–539.

Out of 100 recorded cases of lipoma of the brain, 30 occurred in the corpus callosum. The tumor may be isolated or associated with congenital anomalies, particularly agenesis of the corpus callosum. The tumor lies on the dorsal surface of the corpus callosum which it may partially or completely replace, and is usually anterior, closely related to the anterior cerebral arteries. Calicum or bone is often present in the periphery of the tumor. This gives rise to crescentic bands of density which outline the tumor in anteroposterior or posteroanterior views. There is relative translucency of the tumor itself which may be the size of a pea or as large as an egg.

Ventriculography shows separation of the lateral ventricles anteriorly, with some dilatation of the posterior horns. The third ventricle is slightly dilated and may be elevated or depressed.

Most of the cases which have been treated surgically have either died a short time later or have become "brain cripples." Because of the unfortunate results, diagnosis is important, as the condition of lipoma of the corpus callosum is a contraindication to surgery.—*E. F. Lang, M.D.*

NORLÉN, GÖSTA. Arteriovenous aneurysms of the brain; report of ten cases of total removal of the lesion. *J. Neurosurg.*, Nov., 1949, *6*, 475–494.

The number of reported cases of the successful removal of an arteriovenous aneurysm is very small, but in considering the indications for operation it is pointed out that in the end probably most, if not all, patients with these lesions die of hemorrhage or are completely incompacitated, and that the mental deterioration which is a common feature in cases of an inveterate lesion also strengthens the argument for operative removal of the lesion.

Ten cases are reported by the author representing all the intracerebral arteriovenous aneurysms removed by him from July, 1946, to December, 1948. All of the angiograms were performed after percutaneous injection of umbradil (diodrast, perabrodil) into the carotid artery according to the technique described by Wickbom.

The clinical result of the operation has been very good in 7 patients and all are of full working capacity. In 1 case the ultimate result cannot yet be judged but the postoperative course speaks in favor of a good result. In 2 cases an improvement has occurred when the symptoms before and after operation are compared, but both are invalids, one with pronounced aphasia and the other with hemiparesis. Even if a further improvement is possible, the destruction of brain tissue from the intracerebral hemorrhage has been too large to permit the patient to regain full working capacity.

The most interesting thing in this series was the angiographic study of the brain circulation and the appearance of the brain vessels before and after removal of the lesion. In most of the cases there was a very rapid return to the normal, usually within two to three weeks, of vessels which before the operation were enlarged and tortuous. In other cases, pathological vessels were still visible in the angiogram after that time, but a few months later they regained their normal appearance. From angiograms performed before operation it was evident that the contrast filling of vessels not belonging to the group of vessels that went to the aneurysm was very poor. This might indicate poor nutrition and anoxemia of these parts of the brain, which might cause brain atrophy and be responsible for mental symptoms as are common in inveterate cases. Angiography following operation gives valuable information not only about the completeness of the removal but also about the brain circulation and the condition of the brain vessels.

Encephalography revealed no significant findings in these cases. In one instance a small irregular calcification the size of a pea was demonstrated in the roentgenograms of the skull and later found to be situated in the aneurysm.—*K. K. Latteier, M.D.*

Boldrey, Edwin, and Miller, Earl R. Arteriovenous fistula (aneurysm) of the great cerebral vein (of Galen) and the circle of Willis. *Arch. Neurol. & Psychiat.*, Dec., 1949, *62*, 778–783.

Arteriovenous fistula (aneurysm) connecting the great cerebral vein (of Galen) and the circle of Willis is a congenital anomaly, apparently of rare occurrence. Only 5 examples of this defect have apparently been described in the literature and 1 in a personal communication to the author. The case histories of 2 living patients in whom this anomaly was discovered by cerebral angiography are given and the clinical course and treatment are discussed. One case, that of a sixteen month old child, was studied because of progressive enlargement of the head, a continued bruit, and two subarachnoid hemorrhages. The other, a fifteen year old boy with swollen veins about the right eye and forehead, was also found to have a bruit clearly audible over the entire head, venous engorgement and unilateral exophthalmos. Study of these 2 cases and of those reported in the literature leads the authors to feel that vascular engorgement of vessels of the scalp in the presence of a pronounced and persisting bruit is sufficient justification for the study of the cerebral vascular tree, and that the addition of a calcified shell in the pineal region visible roentgenologically, associated enlargement of the head indicating embarrassment of the cerebrospinal fluid flow, or the occurrence of subarachnoid hemorrhage renders an angiographic examination imperative.

In the cases presented here, the right internal and external carotid arteries were ligated; in the younger patient it was possible to ligate the right posterior cerebral artery distal to its connection with the basilar and the right posterior communicating artery. If the lesion is approached sufficiently early, tributaries may not have become dangerously engorged, and there appears to be hope for the successful interruption of the anomaly. This possibility seems to diminish, however, as the arterial and venous connections enlarge with age.—*K. K. Latteier, M.D.*

Barden, Robert P., and Lewey, Frederic H. Metastasizing cerebellar tumors; the difficulty in distinguishing between medulloblastoma and neuroblastoma. *J. Neurosurg.*, Nov., 1949, *6*, 439–449.

Harvey Cushing's original description of medulloblastoma included a few tumors occurring in older individuals in the second and third decades of life. Not only was the natural history and prognosis more unpredictable in these individuals, but the position of the cerebellar tumors also differed from that in the younger group of patients. Cushing recognized their dissimilarity and suggested the possibility that some of them might be part of the group of neuroblastomas. Considerable argument has ensued about this problem, and the opposing viewpoints of Penfield and Stevenson are quoted. The ambiguous nature of the characteristic cell of this tumor raises the question as to whether some of these neoplasms may not be part of the group of so-called sympathicoblastomas. This means neuroblastoma of the sympathetic nervous system and would open the possibility that a primary tumor in the adrenals, the sympathetic chain, or anywhere else in the body in a sympathetic ganglion could metastasize into the brain and bones. On the other hand, such tumors might originate in various organs independently of one another or take origin from sympathetic or other immature nerve cells in the brain and metastasize from there, although no precedent is known for this sequence of events.

The authors' experience indicates that there may be two types of medulloblastoma, one commonest in childhood and very malignant, the other variant less malignant and more frequent in adults but occasionally developing widespread metastasis as illustrated by the 3 cases presented.

Patients with clinical evidence of a cerebellar tumor, particularly those in the second and third decades of life, should be subjected to preoperative roentgenograms of the chest, skeleton and urinary tracts to determine the presence of metastasis or an occult primary tumor outside the central nervous system.

In addition to the difficulty of distinguishing some cases of cerebellar medulloblastoma from neuroblastoma by clinical, roentgenological, or pathologic methods a similar confusion exists between neuroblastoma and Ewing's tumor.

Although radiation therapy contributes a great deal to the management of the typical case of medulloblastoma, it becomes of even greater importance in the group of atypical cases considered in this paper. While roentgen therapy is of value in palliation of most medulloblastomas, it may arrest the disease perma-

nently in older patients with primary cerebellar tumors derived from neuroblasts, by influencing maturation of the cells in the same manner as in the abdominal neuroblastomas. Once metastases to the skeleton and chest have occurred, however, radiation therapy may relieve symptoms temporarily, but will not effect a cure.—*K. K. Latteier, M.D.*

GORDY, PHILLIP D., PEET, MAX M., and KAHN, EDGAR A. The surgery of the craniopharyngiomas. *J. Neurosurg.*, Nov., 1949, *6*, 503–517.

It is the purpose of this paper to analyze the results in 51 cases of patients operated upon for craniopharyngioma. The operation has invariably been approached with the object in mind of total extirpation. This was believed to have been accomplished in 25 of the 51 cases. Six of the 17 who survived what was thought to have been total excision died of recurrence. This means that one cannot be as certain of total removal in this inaccessible type of brain tumor as one can be with others such as the psammomatous meningiomas. Where firm adhesions have not formed between the tumor and adjacent vital structures, such as the optic nerves, the carotid arteries and the floor of the third ventricle, complete removal is possible and is sometimes surprisingly simple. Certain authors have felt that the high mortality rate does not justify an attempt at complete removal of the tumor but insist, rather, that evacuation of the cyst should be done and irradiation then carried out to decrease the activity of the secretory cells. The authors are of the opinion that roentgen therapy is of no value in the treatment of these cases. They believe that too few attempts have been made by competent surgeons to remove these tumors totally. However, a certain number of the craniopharyngiomas, on the other hand, are readily seen to be hopeless from a surgical standpoint because of their large size as demonstrated by roentgenograms.

Clinical manifestations of increased intracranial pressure were a predominant part of the picture presented by the younger patients. With increase in age and the approach of puberty, localized neurological disturbances, and defects in growth and metabolism and sexual maturation became a more prominent part of the picture. Decrease in visual acuity and field defects occurred in a high percentage of cases after the first decade. Roentgen examination of the skull is of great aid in supplementing the clinical examination of the patient. A large number of these tumors are sufficiently calcified so that the diagnosis can be made with certainty from the plain film of the skull. In this series of 51 cases, 65 per cent showed suprasellar calcification and in 63 per cent of the cases the sella showed some degree of abnormality. The changes seen, exclusive of intrasellar and suprasellar calcification, were intrasellar and extrasellar erosion, depression of the floor, thinning of the anterior and posterior clinoids, erosion of the dorsum sellae and ballooning of the sella turcica. In 8 cases, or 15 per cent, the plain film of the skull was negative. Air studies were done on 20 patients. These included pneumoencephalogram and ventriculogram. In 1 case the skull roentgenogram and a pneumoencephalogram were negative.—*K. K. Latteier, M.D.*

BRUSSELL, IRVIN J. Temporomandibular joint diseases; differential diagnosis and treatment. *J. Am. Dent. A.*, Nov., 1949, *39*, 532–554.

An analysis of the histories and treatment of 350 patients with long standing, extensive temporomandibular joint disease forms the basis of this paper. Diseases involving this joint frequently necessitate combined dental and medical attention.

The author divides this group of diseases into three major classifications for the purpose at hand, the first of which is "pain syndromes" and "syndrome complexes." This classification deals with progressive dental occlusal abnormalities and muscular imbalance as a cause of temporomandibular joint disease. A surprisingly large percentage of people in non-selected groups exhibited these symptoms which are ramifying and may incriminate a multitude of dental and otolaryngological conditions. The author gives a detailed outline of these symptoms. They occurred in 63 per cent and 57 per cent of two such groups of 76 and 85 persons respectively. Treatment in this group of diseases involves application of corrective prosthetics and orthodontics.

The second classification is that of "limitation of motion and arthritis." The temporomandibular joint may be involved with either rheumatoid or osteoarthritis. Twenty per cent of patients with systemic rheumatoid arthritis have acute temporomandibular joint involvement. Trauma to this complicated joint may result in cerpitus, pain, swelling, limitation of motion and muscle spasm symptomatically. If degenerative changes in the articular carti-

lages occur, these symptoms are accentuated and indicate osteoarthritic involvement. Roentgenographic findings may be absent in early stages of arthritis in this joint, but later osteoporosis, decrease of the articular space, relative changes in the bone contour with evidence of erosion and projection of bony spicules may be seen. A detailed table classifying the author's 185 cases of limitation of motion is presented. Thirty-one per cent of these cases had associated systemic arthritis. Treatment of this group consists of medical management, physiotherapy, prosthetic and orthodontic measures. The results of therapy in this group of patients are good.

The third classification is that of "atypical neuralgia and pain reflexes" and deals with the complex symptoms of pain about the face, head and temporomandibular joint. Diagnosis of the underlying etiological factor here is imperative for the proper treatment to be instituted. Many of these patients obtain relief with orthodontic and prosthetic measures which reposition the temporomandibular joint. A large percentage of this group of patients exhibited emotional disturbances.

The author stresses the need for thorough roentgenographic study and close medicodental cooperation in evaluating and treating these disorders.—*K. L. Krabbenhoft, M.D.*

Bachi, Sergio. Su di un caso di carcinoma tiroideo della base della lingua. (On a case of carcinoma of the thyroid of the base of the tongue.) *Ann. laring., otol.*, Jan.–March, 1950, *49*, 1–15.

The author reports a case of carcinoma of the thyroid of the base of the tongue which has occurred in a woman forty-eight years of age. The patient was admitted to the Clinica Otorinolaringoiatrica of the University of Torino in Feb., 1948, with a rapidly progressive tumefaction of the throat of two weeks' duration, which, on the day of admission following palpation by the family physician, started to bleed severely. An emergency tracheotomy was performed followed by a ligation of the left external carotid artery. At the time of the tracheotomy it was noted that the thyroid gland was present in its normal position.

After several days of penicillin therapy, the swelling due to the secondary infection had regressed considerably so that on examination an ulcerated tumor of the left base of the tongue could be seen, the posterior part of which extended into the hypopharynx. A biopsy was taken and the microscopic report was that of carcinoma of thyroid origin.

The patient was subjected to intensive roentgen therapy, a total dose of 6,000 r being given in 15 seances. She made a remarkable recovery and was not again seen until one year later when she presented herself with a recurrence of the symptoms. At this time the tumor was the size of a small orange but apparently still localized. In April, 1949, a lateral pharyngotomy according to Trotter was performed and the tumor successfully removed. The histopathologic examination of the specimen showed adenocarcinoma of the thyroid of the base of the tongue.

The author discusses in detail the clinical course, complications, significance of the hemorrhage, palliation obtained by roentgen therapy and the value of the more recent transpharyngeal surgery in carcinoma of the base of the tongue of thyroid origin.

He also reviews the various names used in the literature for designating the thyroid lesions situated at the base of the tongue. The following nomenclature and classification are suggested: (a) ectopic thyroid, indicating the presence of typical thyroid tissue at the base of the tongue with absence of the thyroid gland in its normal location; (b) accessory thyroid, indicating the presence of typical thyroid tissue at the base of the tongue with a normally developed "cervical" thyroid gland; (c) goiter of the base of the tongue, for the designation of those histopathologically proved tumors of the ectopic or accessory thyroid which show the characteristics observed in the corresponding goiters of the "cervical" thyroid gland; and (d) thyroid carcinoma (or sarcoma or any other malignant neoplasm) of the base of tongue to designate that these tumors originate from an ectopic or accessory thyroid located at the base of the tongue.—*T. Leucutia, M.D.*

NECK AND CHEST

Estes, Ambrose C., and Phillips, Charles. Papilloma of lacteal duct. *Surg., Gynec. & Obst.*, Sept., 1949, *89*, 345–348.

A follow-up study of 77 patients, or 88.5 per cent, of 87 cases of microscopically proved intraductal papilloma seen at Scott and White Hospital in the period 1921 through 1946 is presented. Clinical features and principles of surgical management have been discussed. Subsequent trouble in the same breast was reported

in 11.7 per cent of 34 cases in which segmental excision of the lesion was carried out. In the 42 cases followed in which simple mastectomy was performed no further trouble developed. No patients in this series are known to have developed cancer of the breast subsequent to operation.—*Mary Frances Vastine, M.D.*

PRESS, P. Résultats comparés des examens radiologiques collectifs et des examens d'entourage dirigés dans le dépistage de la tuberculose. (Comparative study of the results of examinations of the population at large with the results of examinations of tuberculosis contact cases in the detection of pulmonary tuberculosis.) *Schweiz. Ztschr. Tuberk.*, 1950, *7*, 17–26.

The author was inspired by a paper published in the *Presse médicale* on November 6, 1948, by Poix, Bariety and Benetaux-Girardet, in which a comparative study was made of the occasional and systematic surveys for the detection of pulmonary tuberculosis. The occasional surveys comprised pre-employment examinations, examinations made before returning to work after an illness, examinations of patients having chest symptoms, and examinations in the regular control of subjects suspected of having tuberculosis. The systematic surveys consisted of examinations of the chest of the population at large by the photofluorographic method. It was reported that the positive findings were much more numerous in the occasional survey groups, than in the systematic examinations of the chest, even when the latter were repeated annually.

The author approaches the same problem from a different angle and compares the results of examinations of the population at large with the results of examinations of tuberculosis contact cases. In the former group 11,042 photofluorographic examinations of the chest were made during 1948 in Geneva, on university students, school children, factory workers, and bank and hospital clerks. There were 52 positive cases, or 4.7 per cent. The author, however, reduces this figure to 3.4 per cent by excluding 2 cases, who moved without leaving a forwarding address, and 14 cases who knew of a healed infection at the time of this study. A breakdown of the remaining 36 cases showed 10 cases with cavity formation, and it is noted that none of these 10 cases were asymptomatic. The second group comprised 504 immediate contacts of known tuberculous cases. The latter were registered at the Tuberculosis Center in Geneva. Fifteen positive cases were detected in this group, or 29.8 per cent.

The author concludes that although the number of examinations made is too small to permit definite conclusions on the subject it is undisputable that the examinations made on known contact cases yielded a much higher percentage of positive results than did the examinations made on the population at large, the proportion being 10 to 1. However, every method has its place, and it will be necessary to combine all efforts in order to succeed in restraining this disease which is at the present very widespread in Switzerland.—*S. Silvera, M.D.*

PAULSON, DONALD L., and SHAW, ROBERT R. Chronic atelectasis and pneumonitis of the middle lobe. *J. Thoracic Surg.*, Dec., 1949, *18*, 747–760.

A review of 32 patients having chronic atelectasis and pneumonitis of the middle lobe is presented. The diagnostic pattern of this condition is so characteristic that its separation as a clinical entity is recommended.

A typical history is that of chronic cough which may be worse in dorsal recumbency, right anterior chest pain, hemoptysis with a history of recurrent pneumonia and a low grade fever. Bronchoscopy reveals edema, hyperemia and induration of the bronchial mucosa. Plain roentgenograms usually present evidence of atelectasis and pneumonitis of the middle lobe. Bronchographic findings in their order of frequency are: complete obstruction of the bronchus, incomplete filling in one segment, close grouping of bronchi and bronchiectasis. The surgical specimen usually shows inflammation and edema of the bronchial wall. In 15 patients the lymph nodes surrounding the middle lobe bronchus were unusually large, inflamed and indurated. In 8 additional cases these lymph nodes were calcified, and in 4 of these, calcified material extended into the bronchial lumen. The bronchial obstruction is due to swelling of the mucosa and compression of the bronchus by enlarged lymph nodes.

Various mechanical factors peculiar to the anatomy of the bronchial tree tend to favor involvement of the middle lobe more frequently.

Treatment is surgical.

The most important condition in its differential diagnosis is bronchiogenic carcinoma.—*F. M. Reis, M.D.*

Hodson, C. J. Pulmonary oedema and the "batswing" shadow. *J. Faculty of Radiologists*, Jan., 1950, *1*, 176–186.

More commonly known in this country as the "butterfly" configuration of pulmonary congestion, this interesting finding is presented in a variety of disease processes in the author's cases.

Differing from ordinary pulmonary congestion as seen in mitral disease, basal congestion of chronic heart failure, and scattered consolidations from asphyxia and irritants, this entity follows no anatomical distribution. Almost invariably it occurs in cases of severe dyspnea complicating illness in which strain is thrown on the left heart. The "batswing" may be unilateral or bilateral, but always stops short of the periphery of the lung field and is sharply demarcated. There is no correlation of the distribution of the shadow to segments, fissures, lobes, or gravity. At necropsy the abrupt change from pathological to normal tissue is striking and is not described in any other condition.

Review of the literature and the author's cases show no relation to azotemia, or the prognosis of the underlying cause of left ventricular strain. The author suggests this entity as a point of needed study for workers in the mechanisms of pulmonary edema.—*W. A. Chickering, M.D.*

Cames, Oscar J., and Cesanelli, Alfredo. Diagnóstico y tratamiento del cáncer pulmonar. (Diagnosis and treatment of pulmonary cancer.) *An. de cir.*, Sept.–Dec., 1949, *14*, 77–92.

The authors review 298 cases of pulmonary cancer seen in the five and one-half years ending August 1, 1949. There were only 17 cases in women, a proportion of 1:16 in favor of the male sex. The age varied between thirty-five and seventy-four years. Sixty cases were considered operable. Thoracotomy showed 31 of them already with gross invasion of the hilus or the mediastinum or massive glands rendering exeresis impossible.

The symptoms are carefully analyzed. Only 78 of the patients had been diagnosed from the beginning as suffering from pulmonary cancer. The authors conclude that cancer of the lung has no specific symptoms and this is especially true in the initial phase. Therefore the early diagnosis must be roentgenological. When originating in the main and lobular bronchi, the lesion develops rapidly toward the bronchial lumen and there the symptoms are more or less based on obstruction. On the other hand, neoplasms which develop in the secondary bronchial tree, especially out toward the terminal branches, rapidly cause a break-through of the bronchial walls and they spread eccentrically forming parenchymatous lesions. The initial roentgenologic expression is provided exclusively by the tumor itself, which usually adopts the form of a homogeneous density, more or less rounded. The authors consider tomography and roentgenography following pneumothorax as only exceptional necessities. They do not like the employment of bronchography because the iodized oil is slow in its elimination and its presence in the bronchial tree complicates later examinations and favors the incidence of postoperative pulmonary complications.

Bronchoscopy is indicated in every patient in whom pulmonary cancer is suspected; for it is not only well tolerated but practically without danger in practiced hands. Two hundred and eighteen patients were bronchoscoped and in 142 (65 per cent) direct or indirect signs were found favoring the diagnosis of neoplasm.

Indications for inoperability included the following:

1. Paralysis of the vocal cord, usually the left, in carcinoma of the left lung. In carcinoma of the right lung, right vocal cord paralysis is less frequent.

2. Extension of the tumor to the trachea or the carina.

3. Fixation of the carina and the bronchial tree during respiratory movements.

4. Tracheal angulation due to glandular metastasis.

Tomographic findings are, of course, to be added to the above.

The search for neoplastic cells in the sputum or in secretions obtained by bronchoscopy was made in part of the series. In 50 cases 36 were confirmed by endoscopic biopsy and in 14 by secretions obtained from the sputum. Emphasis is laid on the necessity of repeated aspirations.

Of 60 cases explored, in 29 resections were done, 27 with pneumectomy, 2 with lower lobectomy. Thirteen of the 29 died in from four to sixty days and were considered hospital deaths. Of the 16 survivors, 6 died from metastases in from ten to thirty-two months. Ten patients remain alive and well.

For the inoperable cases roentgen therapy

was given, according to the Stockholm technique, with a tumor dose of 180 to 200 r daily up to the total of 5,550 to 6,000 r. The localization of the tumor must be as exact as possible; the cutaneous fields small and multiple.—*James T. Case, M.D.*

LAMPE, ISADORE, and ZATZKIN, HERBERT. Pulmonary metastases of pseudo-adenomatous basal-cell carcinoma (mucous and salivary gland tumor). *Radiology*, Sept., 1949, *53*, 379–385.

Mucous and salivary gland neoplasms include one group designated at the University of Michigan Hospital as pseudo-adenomatous basal-cell carcinoma; names in the literature for the same tumor include basal-cell carcinoma with cylindromatous transformation, basaloma, cylindroma, adenoid cystic epithelioma, and adenocarcinoma.

Little information is available in the literature regarding pulmonary metastases, but of the authors' 25 cases, 5 were shown to have such metastases. Knowledge gained from this study suggests that numerous other pulmonary metastases may have been overlooked. Pulmonary metastases probably occur frequently.

There are two striking and important features regarding pulmonary metastases of this neoplasm. First, they may be asymptomatic for years. The authors report cases followed for two, three, and seven years, remaining in good health without pulmonary symptoms. The second feature is the sluggish rate of growth of pulmonary metastases. In 1 case dyspnea and cough appeared when the lesions reached a large size, but the patient lived three more years.

These characteristics are the reverse of our usual thinking in regard to pulmonary metastases. The importance in relation to prognosis is obvious. Attempts to control the primary lesion should not be abandoned because of pulmonary metastases.—*A. A. Brewer, M.D.*

HERNÁNDEZ GONZALO, P., PARDO MENÉNDEZ, V., MIQUEL FRANCA, J., and MESA, C. P. Estudio citológico del cáncer del pulmón por las secreciones bronquiales. (Cytologic study of cancer of the lung by means of bronchial secretions.) *Arch. Hosp. Univ., Habana*, Sept.–Oct., 1949, *1*, 427–434.

The authors have made cytologic studies of bronchial secretions in 50 patients since September, 1948. The secretions were obtained by bronchoscopy and bronchial aspiration. In the beginning the Clerf bronchoaspirator was used but at the present this has been replaced by an aspirator designed by Hernández Gonzalo. This aspirator has at its end a 4 cm. long detachable segment which is screwed to the main tube and contains in its interior a piece of cotton for the collection of the aspiration secretions.

The various cells found in the secretions are described in detail and illustrated by beautiful photomicrographs. It was possible to make through this cytologic study a positive diagnosis of carcinoma of the lung in 13 of the 50 cases. It may be added that the group of 50 cases included not only patients in which cancer was suspected clinically, but all patients who were subjected to bronchoscopy for any pathological condition. In 3 of the 13 positive cases the bronchoscopic examination failed to reveal the presence of the tumor.—*T. Leucutia, M.D.*

STOCKLER, A. L., PEREIRA, L. R., and DE MELLO, R. F. Fibroma gigante intra-torácico. (Giant intrathoracic fibroma.) *Rev. méd. da aeronautica*, Rio de Janeiro, Sept., 1949, *1*, 25–38.

Intrathoracic tumors originating from the chest wall are rare. Harper in 1939 was able to collect only 9 cases and Clagett and Hausmann reported an additional case in 1944. The authors therefore feel justified in publishing a similar case which they observed in a man thirty-one years of age.

The patient complained of progressive dyspnea of three months' duration, associated with hacking cough and inability to lie on the left side. Roentgen examination revealed what appeared to be a massive left-sided pleural effusion with displacement of the mediastinum toward the right. Repeated attempts at aspiration, however, remained unsuccessful. A biopsy with the Silverman needle showed the presence of "normal connective tissue." A subsequent bronchogram elicited the additional information that the left bronchus was compressed by an extrinsic or parenchymal mass.

On surgical intervention a huge tumor was found which arose from the chest wall with a base 12 cm. in diameter. It was completely removed with resection of the corresponding portions of the fourth to the eighth ribs. The tumor measured 20 by 23 by 12 cm. and had a weight of 3.1 kg. Microscopically, it proved to be a fibroma. The patient made a full recovery and one year later enjoyed normal health.

Five roentgenograms, one photograph of the specimen and two photomicrographs are reproduced.

According to the authors, this intrathoracic fibroma is the second largest reported in the medical literature.—*T. Leucutia, M.D.*

Shipman, S. J., Stephens, H. B., and Binkley, F. M. Pulmonary alveolar adenomatosis. *Am. Rev. Tuberc.*, Dec., 1949, *60*, 788–793.

The authors present a short review of the subject, and what they consider to be the sixteenth authenticated case of pulmonary alveolar adenomatosis. A fifty-one year old white female had a casual but definite contact with a small flock of sheep shortly before her symptoms began. Many of these sheep at this time were suffering from a type of fatal lung disease. The patient's original symptom was a dry, hacking cough which soon became productive of clear, mucoid, forthy sputum which gradually increased in amount. Symptoms were continuous in varying degree over a period of four years, and during this interval, roentgenograms of the chest showed a segmental type of density in the right lower lobe. Once during the period of observation, the density shifted from the anterior to the posterior portion of the lobe. Lobectomy approximately seven years after the onset of symptoms, revealed a firm, salmon-pink right lower lobe, with a peculiar smooth, solidified surface. Microscopically the alveoli showed varying degrees of metaplasia and replacement by a simple columnar type of mucus-secreting cell. The alveoli were often distended by these cells which rarely exhibited mitosis.

The patient had an uneventful recovery, but about one year after operation there was a recurrence of the glairy, mucoid sputum, and a chest film showed areas of density in the lower part of the remaining right lung. Careful sputum studies at this time were negative for any type of etiologic agent, especially a virus. There was no clinical improvement after courses of streptomycin and aureomycin. The patient is still being followed.

Roentgenologically the condition resembles tuberculosis, carcinoma, or pneumonia. Characteristic is the insidious onset with a long, rather benign course. The fact that the area of involvement shifted from one segment of a lobe to another segment of the same lobe is against the diagnosis of pulmonary neoplasm, and the consolidated area never diminished in size, such as would probably occur in atelectasis secondary to bronchial obstruction.

The history of contact with sheep possibly suffering from Jaagsiekte, or driving disease of sheep, should suggest the diagnosis.—*Harold Fulton, M.D.*

Maier, Herbert C. Intrathoracic pheochromocytoma with hypertension. *Ann. Surg.*, Dec., 1949, *130*, 1059–1065.

A rare case of intrathoracic pheochromocytoma, apparently the first diagnosed during life, is presented. Two other such cases have been found at autopsy. The pheochromocytoma usually occurs in or around the adrenal glands, but may be found elsewhere in the chromaffin system in about 12 per cent of recorded cases. Retroperitoneal portions of the abdomen near the kidneys or in the organs of Zuckerkandl are the usual sites of extra-adrenal pheochromocytoma. Those arising in the paraganglia of the autonomic nervous system are termed "paragangliomata" by some authors. Since the component cells of this tumor produce epinephrine, these patients experience paroxysmal or persistent hypertension. It is suggested that the possibility of this tumor be kept in mind in all cases of hypertension. In general, it seems that those pheochromocytomas of long standing are more prone to produce hypertension of a persistent character.

In the author's case, the patient, in his third decade, developed an unexplained hypertension. A tumor was demonstrated roentgenographically to lie in the mediastinum just beneath the arch of the aorta. This was removed surgically with resultant recovery, the blood pressure returning to normal limits after $2\frac{1}{2}$ years.

The sex distribution of this tumor is approximately equal with more than 50 per cent occurring under forty years of age. It may occur in children. It may be multiple and in about 15 per cent of adrenal pheochromocytomas, bilateral involvement is seen. They are observed in conjunction with neurofibromas and can easily be mistaken for one of them. A few malignant pheochromocytomas have been reported and, interestingly, hypertension is absent due, apparently, to the anaplastic cell composition of these tumors, epinephrine production requiring well differentiated cells. Hyperthyroidism may be symptomatically similar to this condition. The intravenous injection of a benzodioxane may cause a transient drop

in a pheochromocytoma-produced hypertension, whereas this does not occur in other types of hypertension.

Roentgenographic examination of the chest is indicated in all patients with symptoms of excessive circulating epinephrine.—*K. L. Krabbenhoft, M.D.*

EGGIMANN, PIERRE, and WOLTZ, BLANCHE. Adenoleiomyomes multiples des deux poumons. (Multiple adenoleiomyomas of both lungs.) *Radiol. clin.*, Sept., 1949, *18*, 335–343.

The authors describe in considerable detail a case of multiple adenoleiomyoma of the lungs which occurred in a woman aged fifty-seven. The patient was observed for a period of less than a month before she died and the past history contained no clues which might have directed the attention to the pulmonary affection. The only available data were that at the age of five years the patient had a pneumonia and that six months prior to her present observation she was hospitalized elsewhere for six weeks with the diagnosis of cerebral apoplexy, cardiac hypertrophy and marked hypertension. Apparently no roentgen examination of the chest was made.

The present re-hospitalization was because of the hypertension and the danger of another attack of apoplexy. A roentgenogram of the chest revealed the presence of multiple, rather dense, spherical opacities from 2 to 4 cm. in diameter scattered throughout both lung fields (about 12 nodes altogether). There was thickening and enlargement of the hilar shadows with a partial pneumothorax in the left upper chest. The heart was enlarged especially to the left. On the basis of these findings a roentgen diagnosis of pulmonary metastases or multiple echinococcus cysts was made. The negative Weinberg test and the normal sedimentation rate ruled out this latter possibility.

At autopsy, multiple tumors of the lungs were found which on meticulous microscopic examination of several of the nodes proved to be adenoleiomyomas. The authors believe that these tumors are bronchiogenic hamartomas, the predisposition for which is established during the fifth month of the fetal life before the elastic tissue of the lung is formed.—*T. Leucutia, M.D.*

SLAVIN, PAUL. Diffuse pulmonary granulomatosis in young women following exposure to beryllium compounds in the manufacture of radio tubes; report of five cases. *Am. Rev. Tuberc.*, Dec., 1949, *60*, 755–772.

Five case reports of young women with diffuse pulmonary lesions developing after exposure to beryllium in the manufacture of radio tubes are presented. The insidious onset of shortness of breath, cough, and weight loss began in one case while still working and, in another, seven years after leaving the plant. Length of exposure varied from three months to eight years. The beryllium is present in the phosphors which are sprayed on parts of the radio tube.

Two patients died two and three years after onset of symptoms. Both developed spontaneous pneumothoraces at some time during their illnesses and both had a marked cor pulmonale.

The pathology as seen on the roentgenograms consists of bilaterally diffuse granular lesions which over a period of months to years become overshadowed by nodular lesions which may show fine central calcification. Pulmonary fibrosis, blebs and emphysema are prominent. Enlargement of the tracheobronchial nodes may be present.

A detailed report of the one autopsied case revealed diffuse microscopic granulomas somewhat resembling those of sarcoidosis and large hyaline nodules resembling those of silicosis. Hilar nodes were similarly involved. Calcium was present in some of the nodules. Spectrographic and chemical analyses showed the presence of beryllium and a low value of silica. —*H. J. Klos, M.D.*

FALK, MORTIMER S., and NEWCOMER, VICTOR D. Loeffler's syndrome; occurrence in two patients treated with penicillin in oil and wax. *J.A.M.A.*, Sept. 3, 1949, *141*, 21–22.

This is a report of 2 cases of transitory infiltrations in lungs with eosinophilia occurring in 2 patients who had been treated with penicillin in oil and wax. Loeffler's syndrome has been described as an allergic reaction occurring principally in persons with parasitic disease. The authors postulate that the vascular system becomes hypersensitized to an extrinsic allergen and that the small blood vessels and capillaries of the lungs act as one of the shock structures. The damage to these vessels causes increased permeability of their walls, resulting in the pulmonary infiltrations. The authors believe that the wax was responsible for the allergenic reaction in each patient. Both cases

were being treated for syphilis with the penicillin and wax preparation.—*E. A. Addington, M.D.*

Heacock, C. H. Pneumonia in children following the ingestion of petroleum products. *Radiology*, Dec., 1949, *53*, 793–797.

The author reports on 156 children admitted to the hospital because of ingestion of petroleum products, usually kerosene. Immediate symptoms are burning in throat, choking and coughing and frequently epigastric pain and vomiting. Following absorption drowsiness, collapse and coma may appear. There is usually an associated elevation of temperature and increase in pulse and respiration rate.

One patient died. Postmortem showed generalized confluent hemorrhagic edema of lungs.

One hundred and three children exhibited toxic symptoms. Among these, 68 developed bronchopneumonia with physical and clinical findings.

In all cases roentgenographic changes were confined to lower lobes and were usually bilateral. The changes varied from small coalescing areas of consolidation in cardiophrenic angles to complete lobar consolidation in rare cases. The changes varied in degree according to severity of symptoms and amount of irritant present. There is nothing pathognomonic in the roentgen manifestation of kerosene pneumonitis. Roentgen study is an aid in demonstrating the rate and completeness of the resolution.

Five illustrative chest roentgenograms are shown.—*E. E. Seedorf, M.D.*

Gelfand, Micheal. Paraffin pneumonia. *Brit. M. J.*, Nov. 19, 1949, *2*, 1151–1152.

Infants occasionally ingest paraffin (kerosene) particularly where kerosene lamps are used. This is often followed by acute onset of respiratory symptoms with cough and some rise in temperature (100–103° F.). The child does not appear dangerously ill but some crepitation may be heard and occasionally there are signs of consolidation. A chest roentgenogram taken twenty-four to thirty-six hours after onset shows "cotton-wool" opacities, most often at the bases, and, occasionally, consolidation. The temperature remains elevated for a few days and then the child recovers.

The author reports 5 cases all of whom recovered within six days. Four had roentgenograms showing patchy or lobar consolidation.

The mechanism of respiratory irritation is not entirely clear. Experimental work has been reported in the literature as indicating that there is both aspiration into the lungs and absorption from the blood stream.

Some deaths have been reported in the literature. Severe cases have shown degenerative effects in the liver, spleen, kidneys, and myocardium. Transient cerebral symptoms may occur early.—*H. J. Klos, M.D.*

Hartz, Alvin S. The diagnosis of pneumonia preceding tuberculosis. *Ann. Int. Med.*, Dec., 1949, *31*, 1066–1077.

A group of 500 patients admitted to a tuberculosis hospital was selected at random. Cases with a history of influenza or grippe were excluded and only those cases giving a history of pneumonia as diagnosed by a physician were further investigated.

Of these 500 patients, 71 (14.2 per cent) gave a history of pneumonia antedating closely enough the discovery of tuberculosis to suggest some relationship between the two infections. Of the 71 patients 48 were treated for pneumonia at home and 23 were treated in a hospital. Those who where found to have tuberculosis at the time they were undergoing treatment for pneumonia are not included. Therefore about 15 per cent of this group of 500 patients suffered the ills of an incorrect or delayed diagnosis.

The explanations for the diagnosis of pneumonia in these cases are given: (1) pneumonia existed without tuberculosis, (2) pneumonia was superimposed on a tuberculous infection, (3) misinterpretation of tuberculosis for pneumonia (the latter probably being the most common).

The following factors account for the difficulty in distinguishing non-tuberculous pneumonia from pulmonary tuberculosis: (1) tuberculosis may be heralded by a high fever, subsiding in a few days, (2) the leukocyte count may be as high in tuberculosis as in lobar pneumonia, (3) tuberculosis may be restricted to a lower lobe, (4) in early tuberculosis, prior to caseation, difficulty may be experienced in getting a positive sputum, (5) the course of either disease may be atypical clinically and roentgenologically. One series of 58 cases of tuberculosis has been reported, most of them with positive sputa, in which roentgenographic evidence of tuberculosis cleared in six weeks to

several months. Various authors have previously stated that an acute onset of tuberculosis with or without pneumonia varies between 20 and 50 per cent of cases. It appears that the history of pneumonia preceding the onset of tuberculosis is much more common than has previously been reported. With the advent of antibiotics and more cases of acute respiratory disease being treated at home, costly mistakes in diagnosis may become more common. Resistant cases are frequently classed as atypical pneumonia. In all acute pulmonary disease, tuberculosis must be seriously considered and checkup examinations are mandatory.

Roentgenographic examinations and case reports are presented.—*K. L. Krabbenhoft, M.D.*

MEADE, RICHARD H., and BLADES, BRIAN B. The surgical treatment of recurrent and chronic spontaneous pneumothorax of non-tuberculous origin. *Am. Rev. Tuberc.*, Dec., 1949, *60*, 683–698.

There are three types of non-tuberculous spontaneous pneumothorax. In the first, there is a single attack which is recovered from without sequelae or incident. In the recurrent type, the attacks may be of short duration or may last for weeks or months, making the patient an invalid. In the chronic type, re-expansion does not occur spontaneously nor with aspiration of air.

Of 8 cases with recurrent spontaneous pneumothorax which was incapacitating, all were subjected to open thoracotomy. In 3, the cause for the condition was not found, but the entire pleura was dusted with talc and sulfanilamide. The lungs remained re-expanded. The other 5 cases in this group presented emphysematous blebs which were thought to be the cause. When there were few blebs these were excised with suture of the defects. When the blebs were multiple they were not distrubed, but the pleural surfaces were dusted with talc and sulfanilamide. In all these cases it was first determined that the lung could be completely re-expanded.

In 11 additional cases, it was demonstrated that the lung was not capable of full re-expansion before operation. In 9 of these, the cause of the pneumothorax was found at open thoracotomy. The causes were: leaking bronchiogenic cyst, leaking emphysematous cyst, patency of a bronchopleural fistula maintained by an adhesive band, and a small leak in the surface of the lung. In all these the defect was either sutured, invaginated, removed, or a lobectomy was done. In 3 of these a decortication was necessary before complete re-expansion occurred. In the other 2 cases of chronic pneumothorax no cause could be found, but in both a decortication was necessary to permit re-expansion.

The authors emphasize the importance of recognizing and removing adhesive membranes in the treatment of chronic pneumothorax, and of inducing a sufficient pleuritis in the management of recurrent pneumothorax. They feel that if there is not a prompt response to aspiration of air and the induction of a chemical pleuritis, an open thoracotomy should be done. —*E. F. Lang, M.D.*

YANNITELLI, S. A., WOODRUFF, C. E., MUELLER. E. E., and HOWARD, W. L. Fatal tension pneumothorax resulting from diaphragmatic rupture in a patient receiving pneumoperitoneum. *Am. Rev. Tuber.*, Dec., 1949, *60*, 794–800.

The complications of pneumoperitoneum which might be observed by the radiologist are: air embolism, ascites, peritonitis, mediastinal emphysema, atelectasis, and rupture of the diaphragm. The last named entity is being reported for the first time.

A sixteen year old colored girl with moderately advanced pulmonary tuberculosis was subjected to pneumoperitoneum which was maintained without difficulty for nine months. Twenty days after an air refill she suffered a sudden onset of mild subscapular pain. Roentgenograms revealed a partial collapse of the right lung, a small amount of fluid at the right base, the intraperitoneal air relatively diminished in amount, and two adjacent bleb-like shadows, each 7 mm. in diameter, projecting above the middle of the right leaf of the diaphragm. Air was aspirated from the right pleural space. Pneumoperitoneal refills were cautiously resumed and continued for six weeks. Eight days after the last refill the patient again complained of right shoulder pain. Respirations became labored, and she died a few hours after the onset of symptoms.

At postmortem, before the body was opened, a pressure of 14 cm. of water was present in the right pleural space; after the peritoneal cavity was open, the pressure in the right pleural space dropped to 8 cm. of water, thus demonstrating a communication between the peritoneal cavity and the right pleural cavity. The

right lung was collapsed. Projecting from the right hemidiaphragm in the region of the central tendon, was a soft, whitish mass (1.7 cm. in length and 0.7 cm. in diameter). This proved to be a sinus tract lined by granulation tissue and connecting the peritoneal cavity with the right pleural cavity.—*Harold Fulton, M.D.*

Bogoch, A., and Walker, J. E. The diagnosis of pulmonary emphysema. *Canad. M. A. J.*, Dec., 1949, *61*, 611–618.

The diagnosis of chronic vesicular pulmonary emphysema is difficult to make except in its late stages. The purpose of this paper is to aid in its earlier diagnosis and earlier differentiation from other pulmonary or cardiac causes of dyspnea to expedite proper therapeutic measures and to apply preventive measures where indicated. This form of emphysema must be distinguished from (1) acute vesicular emphysema, (2) senile emphysema, and (3) compensatory emphysema.

Chronic vesicular "large lung" emphysema is defined as an increased volume of the lungs due to abnormal distention of the alveoli with stretching, thinning, and rupturing of the alveolar walls, loss of pulmonary elasticity and formation of superficial blebs and bullae. A reduced pulmonary capillary bed results from capillary damage and arteriosclerotic change. Due to the increased resistance in the pulmonary circuit, right-sided heart failure may result.

The pathogenesis of this condition is poorly understood but, in general, may be due to partial chronic inspiratory or expiratory obstruction, impairment of elastic elements in the lung tissue or other abnormal stresses.

Clinically, this disease is insidious in onset and may mask the underlying disease process. Three stages are depicted for purposes of diagnosis and prognosis. The first, an early compensated stage, may persist unrecognized for years. This is followed by the stage of inadequate compensation when pulmonary or cardiac insufficiency comes to the fore. Finally, the terminal stage of decompensation with death occurring from pulmonary insufficiency or intercurrent bronchopneumonia is seen. In most cases, chronic cough and asthmatic dyspneic attacks are the most commonly encountered symptoms. Progressively increasing exertional dyspnea is the most constant finding but orthopnea is usually not present. Cyanosis is a frequent sign. Utilization of the accessory respiratory muscles, a barrel-shaped chest, diminished diaphragmatic excurison, distant heart sounds, decreased breath sounds, hyperresonance to percussion, prolonged expiration and signs of right-sided heart failure may occur independently or in various combinations. The authors assess the relative worth of the above symptoms and signs in evaluating each case.

A vital capacity of less than 60 per cent of the normal standard as calculated from the surface area, or less than 75 per cent in individuals under fifty years of age is significant and, roughly, a vital capacity under 3,000 cc. in an adult is abnormal. Spirometric tests which permit reasonably accurate estimation of the degree of plumonary impairment in emphysema are discussed at length. Compensatory polycythemia is common due to impaired hemorespiratory exchange oxygen and carbon dioxide.

Roentgenoscopically, increased aeration of the lungs and flattening and decreased excursion of the diaphragm are observed. Roentgenographically, emphysematous blebs or bullae at the outer lung fields and at the bases as well as apparent accentuation of the hilar markings are of some importance in the diagnosis of emphysema. However, such findings as hyperillumination of the lung parenchyma, low position of the diaphragm, direction of the ribs, and the width of the intercostal spaces can be misleading due to the technical factors and errors involved. Roentgenograms made in expiration may help to evaluate the degree of diaphragmatic depression and will demonstrate the more reliable diminished excursion of the diaphragm.

The authors stress the importance of carefully correlating the observed symptoms, signs, and roentgenographic findings with the individual's body type, technical variations and physiologic factors.—*K. L. Krabbenhoft, M.D.*

Goldstein, Philip. Fatal interstitial and mediastinal emphysema following accidental needle perforations of the trachea during jugular venipuncture. *Am. J. Dis. Child.*, Sept., 1949, *78*, 375–383.

In this paper the author reports 2 cases of accidental fatal perforation of the trachea in infants during venipuncture of the internal jugular vein. The cases are briefly detailed and the mechanism of production of pulmonary interstitial emphysema, pneumomediastinum and pneumothorax are discussed. Following needle puncture of the trachea, air rapidly

enters the fascial planes of the neck extravasating into the subcutaneous tissues and down into the mediastinum and, by rupture, into the pleural cavities.

Puncturing the neck with a needle to draw blood from the internal jugular vein is not without danger in that the close proximity of the trachea exposes that structure to a perforating injury which may be rapidly complicated by fatal interstitial and mediastinal emphysema. Diagnostic or therapeutic venipuncture in this location should be carried out with the greatest of care because of the danger involved. No roentgenograms of the patients are reproduced in the paper.—*R. S. Bromer, M.D.*

Vieten, Heinz. Die gezielte Bronchographie mit wasserlöslichen Kontrastmitteln. (Directed bronchography with water soluble contrast media.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1950, *72*, 270–281.

Vieten outlines a method of bronchography using topical anesthesia and catheter instillation of a water soluble medium. He uses opaque catheters with assorted tips and curves including a type curved in two planes to enable entry into certain bronchial segments. The disadvantages of iodized oil are enumerated which include late chemical effects, interference with subsequent examinations and surgery, reactivation of inflammatory lesions together with the inherent physical disadvantages.

The author mentions the work of Mülly (Zürich) who uses a mixture of joduron-B and sodium carboxymethylcellulose to increase the viscosity. Lacking a source of this he uses a mixture of perabrodil and an organic compound related to viscose. The exact nature of these preparations is not given save that the perabrodil comprises 50 per cent of the mixture and that the viscosity of the medium can be altered and controlled. Three grades of viscosity are used, centipoise measurements of the media are given and a number of illustrations of bronchograms are presented.

The use of a water soluble medium appears to have great promise; not the least of its characteristics is that it is rapidly expelled from the lung without residue in three hours.—*Leo A. Nash, M.D.*

Fleischner, Felix G. The pathogenesis of bronchiectasis; a roentgen contribution. *Radiology*, Dec., 1949, *53*, 818–833.

The author presents a rather complete discussion of the subject pointing out that there is no unanimity of opinion regarding anything about bronchiectasis with exception of the definition. He suggests defining it as a condition characterized by dilatation of bronchi.

The following features of bronchiectasis are then discussed: pathomechanics of acquired bronchiectasis, necrotizing bronchitis and bronchopulmonary abscess, and mechanical forces dilating the bronchi consisting of pressure from inside and that from outside.

From this study they found four roentgen observations which changed their conception of the pathology of bronchiectasis. They concluded that roentgenology has proved the frequent occurrence of bronchiectasis, formerly regarded as a rare condition, and has enabled early diagnosis. It has encouraged and helped to make successful the surgical treatment. In every individual case, the diagnosis is established by, and the indication for surgery is partially based on, the detailed roentgenologic findings.

This is a most complete and well worked-up article.—*R. D. Moreton, M.D.*

de Moraes, Clóvis Cardoso. Contribuição ao estudo das bronquiectasias. (Contribution to the study of bronchiectases.) *Rev. méd. aeronáutica*, Dec., 1949, *1*, 18–46.

The author discusses in detail the etiology, pathology, symptomatology, diagnosis and treatment of bronchiectasis.

The etiologic classification of Graham is accepted according to which bronchiectasis may be due to: (*a*) intrabronchial causes including foreign bodies, bronchial calculi and tumors; (*b*) bronchial causes such as mucosal changes, bronchitis, loss of elastic tissue, modifications of the muscles and cartilages, hypersecretion, narrowing of the lumen, etc.; (*c*) peribronchial causes, consisting chiefly of enlarged lymph nodes and mediastinal adhesions; (*d*) pulmonary causes, the most frequent being pneumonia, fibrosis, abscess, tuberculosis, emphysema, etc.; (*e*) pleural causes, mainly bronchopleural fistulae and adhesions; and (*f*) deformities of the thoracic cage.

The diagnosis is based on (1) clinical history, (2) physical findings, (3) laboratory findings, (4) roentgen study supplemented by bronchography, (5) bronchoscopy and (6) diagnostic

pneumothorax. The relative value of each of these procedures is discussed at length.

Simple roentgenography gives only limited information by indicating some bronchial anomaly or an increase of the hilar shadows with accentuation of the peribronchial markings and of the vascular trunks.

Bronchography, however, is of great aid. Its technique is briefly described. Contraindications are: concomitant pneumonias, in which case one must wait two or three weeks after their resolution, congenital cardiac insufficiencies, severe pulmonary emphysema and active tuberculosis.

By following the procedure of Ballon, the author distinguishes five patterns of bronchograms in bronchiectasis characterized by: (1) signet-ring; (2) club-shaped; (3) cylindrical; (4) saccular and (5) moniliform projections of the terminal branches of the involved portion of the bronchial tree. In certain cases the narrowing of the bronchial lumen prevents the full descent of the lipiodol into the lung rendering the interpretation of the roentgen image rather difficult. No secondary effects on the injected bronchi were observed from the lipiodol.

The treatment is divided into (A) nonsurgical, consisting of (1) rest, (2) appropriate climate, (3) dietetic regimen, (4) postural drainage, (5) heliotherapy and (6) topical applications; and (B) surgical, consisting of lobectomy and more recently of segmental lobectomy according to Overholt's method. In this latter instance, if a bilateral lobectomy has been performed, the occurrence of atelectasis is prevented by prophylactic bronchoscopy. The re-expansion of the lungs is checked by means of repeated roentgen examinations.—*T. Leucutia, M.D.*

Bissolino, Gerolamo. Coagoli liberi nel cavo pneumotoracico extrapleurico. (Free coagula within extrapleural pneumothorax cavity.) *Arch. di chir. ortop. e di med.*, Jan.–Feb., 1950, *15*, 104–111.

The author presents and discusses 2 patients with pulmonary tuberculosis in whom extrapleural pneumothorax was instituted therapeutically. He discusses the roentgen diagnosis of blood coagulum within the cavity, its prognostic significance and the treatment.

Roentgenographically, the semi-solid coagulum may be demonstrated earliest twenty-four hours after the institution of the extrapleural pneumothorax as a uniform density within the cavity. Since the coagulum is encased in serum, it will shift position upon changing patient's position. The differential diagnosis between blood coagulum and fluid is made by the presence of a convex upper border which may be continuous with other band-like or triangular densities extending across the air cavity. Although this border may change its shape slightly, it will never assume the straight or slightly concave border of non-coagulating fluid.

The author believes that by decreasing the amount of vasoconstrictors used at the time of operation, hemorrhage which occurs after the effect of vasoconstriction has worn off will be considerably diminished.

Empyema and adhesions of the cavity are the chief complications of hemorrhagic coagulum. Both may be avoided by costostomy with lavage of the coagulant as soon as diagnosis is established. In the author's experience, the wound following costostomy heals rapidly and continuation of the extrapleural pneumothorax is not interrupted.—*C. A. Priviteri, M.D.*

Marks, J. H., Sosman, M. C., and Schlesinger, M. J. Massive calcification in infarcted myocardium. *Radiology*, Jan., 1950, *54*, 33–42.

The authors present a study of 14 patients with this condition. In 8 of these patients the calcification was visible in films made during life. Postmortem examination was made in 9 of the patients. A control series of 63 consecutive old myocardial infarcts without calcification was also studied.

An analysis of the age incidence and clinical features is made. They are predominantly in the older age groups, and predominantly in males. Both the clinical and pathological features are discussed, and the findings summarized in two tables. The roentgen features included cardiac enlargement in all cases, with left ventricular enlargement in all. In 2 cases the contour exhibited a discrete rounded protrusion readily classified as a ventricular aneurysm. Myocardial calcification was demonstrated in 8 of the 10 patients who had films made during life. In 6 of these the calcification involved the cardiac apex. Seven patients were studied fluoroscopically, and the calcification was seen to move with the heart beat. Two cases showed decrease or absence of pulsation in the involved area. Paradoxical pulsation was seen in one at the edge of the infarct.

Two illustrative case histories are presented, with excellent reproductions of antemortem and postmortem films.—*D. S. Kellogg, M.D.*

FREEMAN, N. E., FULLENLOVE, T. M., WYLIE, E. J., and GILFILLAN, R. S. The Valsalva maneuver; air for the contrast visualization of the aorta and great vessels. *Ann. Surg.*, Sept., 1949, *130*, 398–416.

In this interesting article the authors present their experience in 13 patients in obtaining arteriograms of the aorta and great vessels using the Valsalva maneuver as an essential part of the technique. On the premise that roentgenographic visualization of the vascular system requires a high local concentration of radiopaque dye (70 per cent diodrast), the writers demonstrate that the temporary diminution of the cardiac output by the Valsalva maneuver permits a bolus of dye to form in the aorta or large artery. Successive films then clearly reveal the passage of the opaque mass through the arterial system. The procedure was found to be successful in establishing a diagnosis in 10 of the 13 cases.

Points of technique are discussed with regard to each case. The fact that the Valsalva maneuver can be dangerous is emphasized. These dangers include: (1) possible irreversible changes in the brain or myocardium from anoxia during the period of reduced cardiac output, (2) rupture of a weakened area in the arterial tree of a hypertensive patient during the rebound after the period of expiration when the blood pressure may reach a very high level (this is well shown by slide of Dr. Smithwick during the discussion), and (3) possible injury to the intracranial or coronary arteries if a high concentration of diodrast is allowed to reach them. —*T. D. Allison, M.D.*

ARENDT, JULIAN, and CARDON, LEONARD. The diagnosis of intra-auricular thrombosis in the living. *Radiology*, Sept., 1949, *53*, 371–378.

Autopsy studies reveal that thrombosis within the ventricles and auricles is frequent in heart disease, but rarely is the condition recognized clinically. The diagnosis is becoming important with the advent of modern anticoagulant treatment and cardiac surgery.

Arendt and Cardon discuss extensively the pathology, physiology, and the clinical and roentgen findings in intra-auricular thrombosis.

The authors conclude it is important for the roentgenologist to recognize that a *variable sector* of the left heart border is taken up not by the pulmonary artery and pulmonary cone, but by the left auricle and its appendage. Their observations have shown that undue prominence of the left auricular appendage is frequently due to thrombus formation in the left auricle. They have been unable to identify non-calcified thrombi in the right auricle.— *A. A. Brewer, M.D.*

JANKER, ROBERT. X-ray cinematography in congenital heart-disease. *Lancet*, Jan. 28, 1950, *1*, 160–161.

Angiocardiography by rapid serial roentgenography is often sufficient for diagnostic purposes. However, the author believes that since it cannot give a continuous picture of the filling of the heart and great vessels, it may miss some important details. In his department he has now abandoned serial roentgenography in favor of roentgen cinematography.

The apparatus consists of a tube with a focus of 1.4 mm. over a lead protected table in which is placed a fluorescent screen. The screen is face down and has a fine line grid against its under surface. The image on the screen is reflected by a silver surfaced mirror. The lens on the camera has an aperture of 1:0.85 and is equipped with a rotary shutter which permits exposure of the highly sensitive 35 mm. film through 270° of each revolution.

The author uses 90 kv., 80 ma., and a focal film distance of 65 cm. This intensity may be used because the procedure only lasts six to eight seconds. The skin receives 50 r during this time. About 18 frames are exposed per second.

The procedure is to place the patient on his back without anesthesia; 30 to 50 cc. of 70 per cent diodrast or similar substance is injected into the median cubital vein in one to two seconds. Oxygen seems to control untoward reactions.

A typical case of tetralogy of Fallot with roentgen findings is presented.—*R. A. Hays, M.D.*

HELLERSTEIN, H. K., and SANTIAGO-STEVENSON, D. Atrophy of the heart; a correlative study of eighty-five proved cases. *Circulation*, Jan., 1950, *1*, 93–126.

In the protocols of 2,000 consecutive autopsies, 85 showed atrophy of the heart. The clinical histories, electrocardiographic tracings and roentgenograms of the chest, in the cases

in which these had been made shortly before death, were analyzed in detail.

In 67 of these cases roentgenograms of the chest had been made in the terminal part of their illness. Various measurements and ratios were calculated to determine (1) whether there was constant relation between transverse diameter, or cardiothoracic ratio, and the actual weight of the heart at autopsy, and (2) whether the Ungerleider table applied in these cases of atrophic heart. The transverse diameter ranged from 9.5 to 15.5 cm. Twenty-five per cent had diameters below 11.0 cm., 38 per cent between 11.0 and 13.0 cm., and 36 per cent between 13.0 and 15.5 cm. The transverse diameters were thus found to be within the normal range.

The cardiothoracic ratios were found to be equally unsatisfactory as an index of atrophy of the heart. For example, in the patient with the smallest cardiothoracic ratio, 0.32, the heart weighed 260 gm., while another patient with a cardiothoracic ratio of 0.55 had a heart weighing 180 gm. Another patient with a cardiothoracic ratio of 0.53 had a heart weighing 300 gm.

The prediction tables of Ungerleider were found entirely inapplicable to these cases.

The transverse diameters of these hearts by roentgen study were in the lower part of the normal range. Yet, many of the hearts of the least weight had larger transverse diameters and cardiothoracic ratios than the heavier ones. Hence dilatation must have been present in many of these instances.—*Irving Schwartz, M.D.*

Sossai, Michele. Sulla diagnosi differenziale tra pericardite essudativa e dilatazione cardiaca. (The differential diagnosis between exudative pericarditis and cardiac dilatation.) *Radiol. med.*, Dec., 1949, *35*, 979–984.

The author acknowledges the difficulty, not infrequently encountered, in distinguishing between pericardial effusion and cardiac dilatation.

He surveys the roentgen criteria which have been accepted and concludes that although in many cases they permit an accurate diagnosis, none may be considered pathognomonic.

He offers three signs that may shed further light on this problem.

In pericardial effusion:

1. The bifurcation of the trachea does not significantly change in position; the left main bronchus is not displaced.

2. The apical portion of the cardiac shadow is dense. The effusion tends to collect in this dependent region.

3. There is a widening of the hilar shadows with poorly defined margins.

In cardiac dilatation:

1. The main left bronchus is elevated.

2. There is evidence of diminished density of the apex of the heart. This may be due to a thinning of the muscular wall.

3. The hilar shadows are more limited and well defined.—*A. A. Blasi, M.D.*

van Buchem, F. S. P., van Vermeskerken, J. L., and Orie, N. G. M. Transposition of the aorta (Taussig's syndrome). *Acta med. Scandinav.*, 1950, *137*, 66–77.

In a manner of speaking the title of the article is misleading, in that the authors are really presenting a new congenital cardiovascular anomaly which is in some ways similar to the syndrome described by Taussig in 1948. This malformation consists of a transposition of the aorta, a high ventricular septal defect, overriding of the septum ventriculorum by the pulmonary artery, right ventricular hypertrophy, patent foramen ovale and a "functional" stenosis of the pulmonary artery.

This syndrome resembles that described by Taussig concerning the transposition of the aorta, the pulmonary artery's overriding the septal defect, the right ventricular hypertorphy, cyanosis dating from birth, polycythemia, and the presence of higher oxygen content in the pulmonary artery than in the femoral artery.

The differences from Taussig's syndrome include the small conus pulmonalis, absence of hilar pulsations, and low pressure in the pulmonary artery. There is no anatomical stenosis of the pulmonary artery.—*Charles Nice, M.D.*

Apley, John. Congenital anomalies of the aortic arch and its branches. *Proc. Roy. Soc. Med.*, Nov., 1949, *62*, 918–922.

Clinical Manifestations. In the large majority of cases vascular anomalies produce no recognizable effects. When signs and symptoms do occur they vary with age; the older the patient, the more localized the effects. Respiratory disturbances usually predominate in infants and occur soon after birth. Stridor is the commonest and usually the sole manifestation. A misdiagnosis of "thymic enlargement" may be made especially in view of the fact that some vascular anomalies show a roentgenological

widening of the upper mediastinal shadow. In early life difficulties in swallowing are overshadowed by respiratory difficulties, but later they may come to predominate. Occasionally swallowing difficulties occur alone. They usually take the form of slowness in feeding and/or various degrees of irregular vomiting. Respiratory and alimentary symptoms tend to recede with growth of the trachea and esophagus and are usually lost by the age of one year or so.

Diagnosis. Roentgenological investigation, especially fluoroscopy, is indispensable for diagnosis. The anomalous vessel may be visualized or its transmitted pulsations observed, but usually it is demonstrated indirectly by its effect upon the esophagus or trachea. The commonest site of displacement is the level of the 3rd or 4th thoracic vertebra. Barium swallow examination is usually adequate, but in certain selected cases angiograms give an excellent outline of the anomalous vessel.

Treatment. Surgical correction is the only method of treatment. It is indicated in only a small proportion of cases because of the tendency to spontaneous recovery.

Types of Anomalies. There are three main types of anomalies.

1. Double aortic arch: The ascending aorta divides and the two limbs usually encompass both the trachea and esophagus. This anomaly is readily diagnosable by demonstrating the compression of the esophagus posteriorly and the trachea from both sides.

2. Right aortic arch: This is a relatively common anomaly. In the absence of dextrocardia the commonest variety is the posterior type where the aorta crosses the midline toward the left side by passing behind the esophagus.

3. Left aortic arch: In this group disturbances may be caused by anomalies of the aorta itself or by anomalous origin in one of its main branches. In certain malformations, such as truncus arteriosus, compression of the esophagus may be demonstrated roentgenologically. The compression caused by coarctation is best seen in the left oblique view, and may be in the form of a double C. Anomalies of origin of main branches are described in anatomy books, but only a few are encountered clinically, excluding patent ductus arteriosus. The clinical literature is almost entirely confined to anomalous subclavian arteries. Its incidence is said to be 16 in 1,000 autopsies. Roentgenographically the barium-filled esophagus shows a narrow indentation passing obliquely upward from left to right at a level immediately above the aortic arch. It may be anterior or posterior to the esophagus. The rarest type, with the vessel passing anterior to the trachea, has not thus far been diagnosed during life.—*D. R. Bernhardt, M.D.*

ELKELES, A. Calcification of ascending aorta as a diagnostic sign of syphilitic aortitis. *Proc. Roy. Soc. Med.*, Nov., 1949, *62*, 867–868.

A case history of a patient with syphilitic aortitis is presented. Although there was only moderate ascending aortic enlargement, the marked right aortic border calcification led the author to the correct diagnosis. Clinical cardiac findings and a positive Wassermann reaction confirmed the diagnosis.

One of the earliest and most frequent sites of aortic calcification is the abdominal aorta. The author found roentgenological evidences of it in 22.9 per cent of patients over fifty. Abdominal aortic and aortic knob calcification are considered manifestations of arteriosclerosis.

Walls of aortic aneurysms often show calcification, thereby aiding in the differential diagnosis between mediastinal tumor and aneurysm.

A series of cases reported by Jackman and Lubert in 1945 showed linear calcification in the ascending aortas of 22.7 per cent of patients with syphilitic aortitis.—*D. R. Bernhardt, M.D.*

SMITHAM, J. HILLYER. Coarctation of the aorta. *J. Faculty of Radiologists*, Jan., 1950, *1*, 198–221.

A review of the history of diagnosis and treatment of coarctation is given with summations of the theories of etiology and classification of types. The author favors Abbott's theory of anomaly of the 4th and 6th arches and strengthens this with his case of adult type coarctation in an infant only a few months old.

The incidence, morbid anatomy, collateral circulation, and Bramwell's adaptation of Evans' classification are discussed with the author's note of the many cases unable to be classified in any of the systems in current usage.

Associated anomalies and their incidence are shown in a review of the literature. Newhouser's contribution in reporting the changes in the upper incisor teeth is substantiated by the author's cases.

The roentgenological appearance including the findings with barium swallow, kymography, and angiography are described and correlated

with the criteria for clinical and physical diagnosis.—*W. A. Chickering, M.D.*

Gross, Robert E. Coarctation of the aorta; surgical treatment of one hundred cases. *Circulation*, Jan., 1950, *1*, 41–55.

Gross stresses the importance of the simple methods of physical examination and roentgen study in the diagnosis of coarctation of the aorta; i.e., blood pressure determination in upper and lower extremity (blood pressure in upper extremity is increased); simultaneous palpation of femoral and radial pulse (the femoral pulse is delayed).

Roentgenograms of the chest show notching of the fourth to ninth ribs, enlargement of the heart, dilatation of the ascending portion of the aortic arch and flattening of the aortic knob and slight compression of the esophagus due to the dilated thoracic aorta below the level of coarctation.

The author points out that the more complicated and expensive procedures such as angiocardiography and cardiac catheterization are usually unnecessary and occasionally misleading. The major part of this article is devoted to a discussion of the various operative procedures in different types of coarctation of the aorta and an analysis of the results that have been achieved in the first 100 cases. Of these, 11 died at operation or postoperatively. In 9 only exploration was done. Of the remaining 80 cases based on reduction of hypertension the results were complete relief in 71, fairly satisfactory relief in 8, no relief in one.—*Irving Schwartz, M.D.*

Weise, H. Beitrag zur Röntgendiagnostik multipler Aneurysmen der Pulmonalarterien. (Contribution to the roentgen diagnosis of multiple aneurysms of the pulmonary arteries.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1950, 72, 345–349.

This is a case report of a fifty-two year old man who, apparently never seriously ill before, developed a combined mitral valve lesion of the heart following rheumatic fever three years prior to present admission. On the first admission, there was an enlargement and increase in convexity of the pulmonary artery arc. Also, there were many round and oval-shaped shadows of increased density from the size of a cherry to that of a plum, situated in the region of both hila. These were considered as manifestations of stasis as a result of cardiac decompensation. The patient improved symptomatically and the above described hilar shadows were disregarded.

When he returned to the hospital three years later, he was very dyspneic and cyanotic but had no edema. The liver was not enlarged. Blood pressure 140/80. In the region of the apex one heard a swishing systolic and prediastolic murmur. Roentgenologically, the heart was enlarged very much to the left, and also to the right. The pulmonary prominence was exaggerated markedly, seemed to have sharp borders and pulsated actively. In the right hilus there was a dense shadow the size of a fist, which lay partially behind the heart, and pulsated actively. Also, in the right hilar region there were two additional shadows, which pulsated. Two such shadows were also present in the left hilus. All these shadows pulsated synchronously with the pulmonary prominence. The remainder of the lungs showed some increase in markings. In comparison with the film of three years ago, the hilar shadows were larger and more distinct, while the size of the heart was also larger.

The electrocardiogram three years ago did not show a right axis deviation, which should be present in aneurysm of the pulmonary artery. The present electrocardiogram was interpreted as an "atypical Wilson bundle branch block." Roentgenologically, the prominent pulmonary artery shadow which pulsated actively was thought to be an aneurysm of the pulmonary artery.

In the case presented, since the roentgen appearance changed but little over a three year period, and since the shadows described exhibited active pulsations, synchronous with that of the pulmonary artery, the diagnosis of multiple aneurysms of the branches of the pulmonary artery was made. The pulmonary prominence did not become wider over a period of three years probably because thrombotic masses were deposited within the enlarged artery. In this case, a rare thing occurred in that the multiple aneurysms did not involve the main stems of the pulmonary artery but only those branches distal to these main stems. The diagnosis could be made only by roentgen study since clinically no findings suggested the possibility.

One must assume that the polyarthritis produced a toxic damage to the blood vessels, which in the American literature is described as mycotic aneurysms of the pulmonary arteries. An additional factor to the formation of the

aneurysms could have been, in the case presented, an increase in pressure of the secondary circulation which can be produced by the combined mitral valve lesion.—*Samuel Richman, M.D.*

OSLER, A. ABBOTT, HOPKINS, WILLIAM A., and LEIGH, TED F. The role of angiocardiography and venography in mediastinal and paramediastinal lesions. *J. Thoracic Surg.*, Dec., 1949, *18*, 869–891.

A small series of 36 patients is presented in whom mediastinal or paramediastinal masses were studied by means of venography or angiocardiography, or a combination of both.

This method is most valuable for differentiation between vascular and avascular lesions in this area. It has definite but limited use in the study of the nonvascular tumors of the mediastinum. Displacement of certain vascular structures and distortion of a specific vascular pattern help in the localization of the borders of nonvascular tumors and sometimes in determining their point of origin. The relative value of angiocardiography varies with the area of the mediastinum involved. It is best suited for lesions in the middle and also the superior mediastinum especially when located in the right paramediastinal area. Aneurysms of the innominate, left common carotid or left subclavian arteries can be differentiated from lymphomas or thyroid. The constant anterior position of the left innominate vein does not usually allow this procedure to be of value in left superior paramediastinal masses. In lesions of the anterior and posterior mediastinum it may be of limited value by differentiating between intrinsic and transmitted pulsation. Masses in the lower portions of the anterior and posterior mediastinum are best studied by pneumoperitoneum and pneumothorax.

Certain special technical problems associated with each type of lesion are discussed.

Careful fluoroscopic examination and multiple roentgen projection studies must be carried out before determining the particular positions and combinations of angiographic methods to be utilized in the individual study of a specific case. This method is of specific value in the study of bronchiogenic carcinoma, especially when the lesion is situated in the upper lobe beyond the range of the bronchoscope and where lipiodol injection is often unsatisfactory.

The article is followed by an interesting discussion.—*F. M. Reis, M.D.*

PEREIRAS, RAÚL, and CASTELLANOS, AGUSTIN. Retrograde aortography; its value in the diagnosis of coarctation of the aorta by means of a new indirect sign. *Radiology*, Dec., 1949, *53*, 859–867.

The authors discuss the history of retrograde aortography, from the time they first used it through its development. They point out that counter-current aortography has two purposes: In some cases it demonstrates clearly the thoracic aorta and the aortic arch and its emerging vessels. In other cases the abdominal arch and its branches are delineated, including collaterals and the ending of the vessels.

The method is described and both direct and indirect signs of coarctation are discussed.

The method includes superior and thoracic retrograde aortography in which the medium is introduced through one of the vessels of the aortic arch and inferior or abdominal retrograde aortography when the injection is made through the femoral artery.—*R. D. Moreton, M.D.*

OLIM, CHARLES B. Coarctation of the aorta at the level of the diaphragm; case report. *Ann. Surg.*, Dec., 1949, *130*, 1091–1097.

Coarctation of the aorta of the infantile type is incompatible with life. The adult form consists of a stenotic segment which is usually located between the left subclavian artery and the ductus arteriosus. Several cases in which the coarctation was located distal to the usual site are cited.

The author's patient had a coarcted segment just above the diaphragm. The history and physical findings were quite typical. Roentgenographically there was moderate left ventricular cardiac enlargement. Surgical correction of the anomalous aorta was attempted and a second operation became necessary since the stenotic segment was lower than anticipated. The segment, 17 mm. in length with an inside diameter of 4 mm., was removed. An unsuccessful attempt was made to approximate the aortic ends and the patient died five hours postoperatively.

A comprehensive discussion of this case and certain technical aspects of aortic surgery are presented. This is the first case of this kind to be operated upon.—*K. L. Krabbenhoft, M.D.*

SCHLICHTER, J., and HARRIS, R. The vascularization of the aorta. II. A comparative study of the aortic vascularization of several species

in health and disease. *Am. J. M. Sc.*, Dec., 1949, *218*, 610–615.

The vascularization of the aorta in man, dog, chicken, and rabbit was studied by roentgenologic and microscopic techniques after injection of the vasa vasorum using a radiopaque gelatin mixture.

The ascending aorta of the normal dog is supplied by a rich anastomotic network arising from the coronaries, from vessels arising from the great vessels of the aortic arch, and directly from the lumen of the aorta. When the vascularity of the aorta was disturbed experimentally, absence of vascularity was noted. A marked increase in number and irregularity of the vascular network of the injured region was found six weeks after injury.

The vascularity of the ascending aorta of the adult human was comparatively less than that of the dog, but superior to that of the chicken and rabbit. The adventitia and media below atheromatous plaques of the aorta were less vascular. In fibrotic areas, secondary vasa up to 30 microns in diameter were seen. No direct vessels from the intima were found except for stomata. In infants, when the ductus arteriosus was patent, vasa between the aorta and pulmonary artery were demonstrated. The pulmonary artery usually showed better vascularity than the aorta.

The ascending aorta of the rabbit was the least vascularized of all the species.

The species differences are unrelated to the size of the aorta. The radiopaque mixture used was able to go wherever blood would flow. The vessels filled were of physiologic significance in that erythrocytes, with their oxygen supply, could be transported through them.

The basic species differences may explain the differences in producing arteriosclerosis in different animals. The species with better vascularity would have less tendency to develop degenerative arterial lesions. These lesions are less likely to develop in vessels such as the pulmonary artery. The hypothesis is established that the development of degenerative arterial lesions appears to vary inversely with the blood supply to the vessel wall. Other factors are not precluded, but the factor of blood supply is emphasized.

Conditions expected to produce degenerative arterial changes are (1) those in which the demand for blood, especially O_2, is increased without increase in supply, and (2) conditions reducing blood flow, such as luetic aortitis or prolonged anoxemia.—*Benjamin Copleman, M.D.*

Nemours-Auguste, S. L'extrémité inférieure de l'oesophage normal. (The lower end of the normal esophagus.) *Presse méd.*, Oct. 19, 1949, *57*, 960–962.

This excellent article on the lower end of the normal esophagus is accompanied by many splendid illustrations of the normal roentgen *physiology* of this region. Dr. Nemours-Auguste, dean of French radiologists and Chief of the Radiological Service at l'Hospice Paul Brousse, Paris, is an authority on the roentgen study of the esophagus and one of those genuine students in our specialty whose hall-mark is a meticulous and thorough knowledge of the normal anatomy and physiology of his subject and keen interest in research which furthers our knowledge of normal structures and functions.

This paper is primarily a discussion of the true character and function of the phrenic ampulla, a subject which, according to this abstractor, is still too superficially understood by many doing gastrointestinal roentgenology. How many times do we still see a phrenic ampulla called an esophageal hiatus hernia? In this paper the anatomical portions of the distal esophagus are discussed in detail, the demarcation of mucosal folds of the esophagus from those of the stomach is described, attention to proper technique in the roentgenological examination is discussed with the usefulness of a fixed grid with rather wide divisions attached to the fluoroscopic screen to facilitate study of the time of passage of the bolus (illustrated in 7 excellent reproductions).

Some of the conclusions in this article are as follows: The phrenic ampulla has as its function a main rôle as "distributor" of the aliment into the stomach.

It enlarges to the degree or size required by the bolus. It regulates the quantity of ingesta to be passed into the stomach.

The infra-ampullary portion of the esophagus (epicardia) is closed or constricted at the end of expiration. The bolus traverses the anatomical cardia in the course of inspiration.

The inferior end of the esophagus, especially when little distended, is normally sinuous.

The author has never observed a stoppage or hesitation at any point in the lower esophagus which could suggest the presence of a sphincter at the diaphragm or at the cardia.—*William M. Loehr, M.D.*

RENNIE, J. B., LAND, F. T., and PARK, S. D. S. The short oesophagus; a review of 31 cases. *Brit. M. J.*, Dec., 24, 1949, *2*, 1443–1449.

It is not generally appreciated that gastric hernia with associated shortening of the esophagus can produce a variety of symptoms simulating carcinoma of the esophagus, peptic ulceration of the stomach or duodenum, cholelithiasis or coronary artery disease.

The authors describe the clinical features of 31 patients with hiatus hernia and short esophagus seen over a period of ten years. In 26 of the patients the presenting complaint was dysphagia due to obstruction in the lower third of the esophagus. At the same time there were 80 patients with carcinoma in the lower third and 31 with achalasia also complaining of dysphagia due to obstruction. Pain was present in 18 patients, felt primarily in the lower end of the sternum and of a burning nature. Hematemesis occurred in 9 cases. A definite ulcer was demonstrated in the hernia in 2 instances in this group.

Roentgenographic examination is best made in the Trendelenburg position, allowing the herniated portion of the stomach to fill and demonstrating a shortened and narrowed esophagus. Otherwise, a stricture alone may be demonstrated, thus simulating the appearance of carcinoma. In this series, a partial stricture of the esophagus was present in 26 cases, and 15 patients showed an esophageal ulcer. In 1 patient a carcinoma developed in the hiatal pouch of the stomach, and in 3 patients the dysphagia was first noticed a few days following abdominal surgery. In 5 of the patients of the series the onset of esophageal symptoms occurred in the later months of pregnancy. All of these patients were over thirty-five years of age. A rise in intra-abdominal pressure with laxity of the esophageal haitus would seem to be the predisposing cause.

The authors contend that the shortening and stricture formation is produced by gastric juices present in a pre-existing hiatus hernia of the stomach. They find it difficult to accept the hypothesis of congenital shortening of the esophagus. The majority of their patients were treated medically with diet and a number required the passage of bougies from time to time.—*W. M. Roy, M.D.*

LYNCH, J. P. Spontaneous perforation of the esophagus. *New England J. Med.*, Sept. 15, 1949, *241*, 395–400.

Spontaneous perforation of the presumably normal esophagus, formerly considered a rapidly fatal lesion, is amenable to modern surgical and antibiotic therapy provided the diagnosis is promptly made. Spontaneous perforation differs from traumatic perforation, or from that produced by perforation of a peptic ulcer of the esophagus, in the important feature of occurrence during vomiting, thereby flooding the mediastinum promptly with irritant gastric contents. Severe prostrating epigastric or precordial pain occurring during forcible vomiting or retching should lead to suspicion of perforation. There is sudden onset of severe pain, associated with shock and dyspnea, and often with cyanosis. Upper abdominal tenderness and spasm may be present. A pleural effusion, usually on the left, rapidly develops. Air may be palpable in the neck six to twelve hours after onset.

Roentgen demonstration of air behind the heart, or elsewhere in the mediastinum, is diagnostic under the clinical circumstances described. A pleural effusion is often noted, even in early stages. Three cases are described, all showing mediastinal air and pleural effusion in films taken shortly after onset. Early operation aimed at closing the perforation, relieving the mechanical compression of the mediastinum, and drainage of the pleural cavity, should usually prove successful.—*H. P. Brean, M.D.*

CLIFFTON, EUGENE E. Spontaneous rupture of the esophagus. *Ann. Surg.*, Dec., 1949, *130*, 1066–1073.

The author reports 2 cases of spontaneous rupture of the esophagus, 1 of which survived. A review of the literature pertaining to this condition reveals a mortality of 100 per cent in 54 reported cases.

Symptomatically, the patient experiences violent vomiting, usually with hematemesis and with severe epigastric or substernal pain of a constant nature. The pain may be referred to the back, left shoulder or the costal margin. Pleuritic pain may be present and respiratory embarrassment is seen. Signs of interstitial emphysema is most valuable. Foul fluid may be aspirated from the pleural space.

Roentgenologically, mediastinal gas shadows and fluid levels may be present. The diagnosis, if suspected, is confirmed by the extravasation of swallowed lipiodol into the mediastinum or the pleural cavity.

This condition is most often erroneously

diagnosed as coronary occlusion, pulmonary embolus, dissecting aneurysm, perforated ulcer of the stomach or duodenum, acute pancreatitis and renal colic.

The course of these patients is rapidly retrogressive, death often occurring within twenty-four hours and usually within forty-eight hours following the acute onset of esophageal rupture. One of the author's cases followed the characteristic retrogressive course with death occurring 21½ hours after admission. The other recovered due to prompt diagnosis and early surgical treatment with the aid of antibiotics and other supportive measures. Successful treatment depends upon immediate diagnosis and early surgical intervention.

Perforation of the esophagus is more common and is usually secondary to foreign body, stricture or instrumentation. The course here is less precipitous and patients may survive with conservative treatment in some instances. —*K. L. Krabbenhoft, M.D.*

Schein, Clarence J., Judson, Glenn L., and Hemphill, Arthur C. Gastropericardial fistula following transthoracic esophagectomy. *Ann. Surg.*, Dec., 1949, *130*, 1074–1078.

Since the transthoracic approach for esophagectomy is now well established, this report of a postoperative complication of this procedure is presented with the purpose of disseminating all available data to members of the profession. This is the first case reported in which a gastropericardial fistula occurred as the terminal event. Previous fistulae of this type have been reported due to post-radium implantation for carcinoma of the cardia, congenital occurrence, postoperative diverticulo-gastrostomy, foreign body perforation, and rupture of a tuberculous abscess. The authors' patient was afflicted with an adenocarcinoma involving the lower third of the esophagus, demonstrated roentgenographically as an irregular filling defect, and proved by biopsy. A transthoracic resection of the involved segment and esophago-gastrectomy was carried out without untoward incident. He subsequently developed a stricture at the site of anastomosis due to a recurrence of the neoplasm. After several admissions for dilatation of the stricture, on the final admission, one year and seven months following the resection, he presented clinical and roentgenological evidence of pleural and pericardial involvement. Gastrostomy and pericardiostomy were done as palliative measures after various diagnostic procedures confirmed the presence of a fistulous communication between the esophagus or stomach and the pleural-pericardial cavities. Autopsy revealed carcinomatous involvement of the intrathoracic and intra-abdominal structures. Marginal ulceration had occurred at the anastomotic site and the fistula occurred just below this point.

The "splash murmur," roentgenographic demonstration of hydropneumopericardium, and aspiration of injected methylene blue from the pericardial space established the presence of the entero-pericardial communication.—*K. L. Krabbenhoft, M.D.*

Cottet, Pierre. Tumeurs exceptionnelles de l'oesophage: Sarcome polypeux et fibrome sténosant. (Exceptional tumors of the esophagus: polypous sarcoma and stenosing fibroma.) *Radiol. clin.*, Sept., 1949, *18*, 258–265.

The author reports 2 rare cases of esophageal tumors, one representing a polypous sarcoma and the other a stenosing fibroma. In conjunction with these 2 case reports he also discusses the general characteristics of the two types of lesions.

The polypous sarcoma occurred in a man sixty-eight years of age who for a period of eight years prior to his admission had repeated episodes of cardiac decompensation. Roentgen study by means of barium mixture revealed a slight displacement of the lower esophagus corresponding to a length of about 7 cm. above the diaphragm. There were rather deep indentations of the posterior contour of the esophagus which under the effect of the Valsalva test seemed to undergo modifications signifying the presence of esophageal varices. There was a slight narrowing of the lumen of the esophagus without dilatation above the involved area. At autopsy a pedunculated polyplus tumor was found which infiltrated the esophageal wall and which on microscopic examination proved to be a small cell sarcoma.

Sarcoma of the esophagus is so rare that Lüdin in 1938 was able to collect from the literature only 14 cases which were examined roentgenologically. They may occur at any age, there being some preference for the male. Generally they are located in the inferior third of the esophagus and involve a length of from 1 to 17 cm. They may be polypous or infiltrating, the two forms having occurred combined

in the author's case. The characteristic roentgen signs are the widespread indentations which may vary in time and the absence of notable stasis.

The stenosing fibroma was observed in a woman thirty-two years of age who since early childhood had persistent anemia. A difficulty of swallowing associated with some pain in the epigastric region appeared five years prior to her observation. It was noted at the beginning only after the first swallow but later it became more prolonged and it gradually grew in severity. The first roentgenogram revealed what seemed to be an upper mediastinal tumor, extending slightly to the right. During swallowing the opacity moved upward a distance of about 1 cm. The administration of barium mixture revealed the presence of an ovoid dilatation of the esophagus, measuring 8 by 4.5 by 5 cm., the external border of which was superimposed on the opacity of the upper mediastinum. A diagnosis of Zenker's diverticulum was made and an operation was performed. This, however, remained unsuccessful, except for the removal of a few peri-esophageal glands. Since the microscopic study of the excised lymph nodes suggested the possibility of nevocarcinoma, a dose of 8,500 r of deep roentgen therapy was given. Subsequent roentgenograms showed only a slight increase in the size of the upper mediastinal opacity and therefore a second operation was performed later. At this time a tumor of the left wall of the esophagus was found which was successfully removed. The histopathologic report was that of fibroma. The patient made an uneventful recovery, but the anemia failed to disappear indicating that it was independent of the fibroma.

The author was able to collect only meager data from the literature on the characteristics of fibroma of the esophagus. The age limit extends from nineteen to sixty-eight years and the tumor occurs equally in both sexes. There is a special pedunculated form originating on the anterior wall of the organ at the level of the cricoid and extending progressively downward, even as far as the cardia. This tumor is often regurgitated into the mouth and rarely it may be expelled. Other forms, as in the author's case, are located intramurally. Symptoms do not appear until the tumors are rather voluminous. The important roentgen signs are: enlargement of the mediastinum which in all the cases is described as occurring to the right; central esophageal defect with conservation and spreading out of the folds; and fusiform dilatation of the esophagus.—*T. Leucutia, M.D.*

ABDOMEN

DERIU, GIUSEPPE. Prova farmaco-dinamica coll'atropina nella radiodiagnostica gastroduodenale (Pharmacodynamic test with atropine in the gastroduodenal roentgen diagnosis.) *Radiol. med.*, Dec., 1949, *35*, 939–948.

The pyloric and duodenal portions, because of their variable functional states, may present roentgen findings which are difficult to interpret.

Despite many special procedures, it is frequently difficult to fill the first portion of the duodenum.

In the past, many drugs have been used for this purpose, i.e., morphine, ipecac, insulin, amyl nitrite, acetylocholine and others, and more recently, atropine.

Uncertain and contradictory results have been reported following the parenteral injection of atropine sulphate, both in the experimental animal and in man.

In previous experiments the authors had used morphine in the study of gastroduodenal lesions.

In this series of 13 cases, the authors injected 1 mg. of atropine sulphate when the previous visualization of the gastroduodenal tract had not been satisfactory. The drug was well tolerated.

Two distinct phases were observed. At first there was an increase in tone and motility of the gastroduodenal tract; subsequently, a period of inertia, with loss of tone and with dilatation.

The initial increase in tone and motility was very useful in demonstrating organic lesions of the antrum since it produced more sharply defined outlines, and permitted more accurate study of changes in peristalsis.

During the period of inertia, the duodenal bulb was dilated. Prepyloric and duodenal ulcers were more conclusively demonstrated.

Results obtained with atropine sulphate, although not as pronounced as those obtained with morphine, were satisfactory, and were not attended by adverse drug reactions.

The authors recommend this method not only because it is time-saving but also because it will give valuable information.—*A. A. Blasi, M.D.*

Sawyer, P. N., Rhoades, J. E., and Panzer, Ruth. An evaluation of electrogastrography in the diagnosis of gastric cancer. *Surgery*, Sept., 1949, *26*, 470–487.

The authors analyzed a series of 150 electrogastrograms. These are records on which the difference in electrical potential between the gastric mucosa and the skin of the forearm is charted. There were 106 patients on whom 130 tests were made and there were 20 tests made on 12 normal subjects. The electrode applied to the gastric mucosa consisted of a Levine tube filled with 0.1 N hydrochloric acid that permeates a sponge rubber plug in the lower end. This end is placed against the gastric wall opposite the esophagogastric junction by means of roentgenoscopic control. The other electrode contains 0.1 N sodium hydroxide and is applied against a scarified area of the skin of the forearm. A calomel half-cell and a high resistance recording potentiometer are used.

The test is begun after the patient has been fasting for twelve hours. A base-line recording of fifteen minutes' duration is made after which 200 cc. of milk is ingested and another fifteen minute recording made. The records are classified into three groups. Group 1 includes those records in which the slope of the base line changes more than 8 millivolts in fifteen minutes. These records are not considered to be interpretable. Group 2 includes those records that show a rise in potential of at least 3 millivolts. The rise starts within one minute of the ingestion of the milk and lasts at least three minutes before returning to the previous level. Group 3 includes all other curves.

The diagnosis of a benign lesion was made for all patients whose records belonged in group 2. Patients whose records belonged in group 3 were considered to have malignant lesions of the stomach. Of the records made, 8.5 per cent had to be discarded. A correct diagnosis was made in 87 per cent of 30 patients whose records belonged in group 3 and in 88 per cent of patients whose records belonged in group 2. The authors suggested that on the basis of these results the method may prove of value as a screening test in detection of cancer and that it should be less expensive than roentgenologic gastrointestinal examination as now conducted.—*C. B. Holman, M.D.*

Maddock, Walter G., Bell, John L., and Tremaine, Myron J. Gastro-intestinal gas: observations on belching; during anaesthesia and operations, rapid passage, and during pyelography. *Ann. Surg.*, Sept., 1949, *130*, 512–537.

Swallowed air is the chief source of gas in the gastrointestinal tract. A brief historical account cites various experimental works substantiating this fact. The authors are interested primarily in the mechanism by which air enters the esophagus and stomach. Swallowing of air is partially responsible but the superior esophageal sphincter and respiratory movements are important factors as well. Conditions under which air enters the esophagus and stomach without swallowing are acute gastric dilatation, air-sucking and esophageal speech.

In human subjects it has been shown previously that:

(1) Active attempts to breath against a closed glottis can produce negative pressures in the esophagus and stomach up to 30 cm. of water.

(2) The superior esophageal constrictor muscle opens on deglutition to allow passage of food and fluids. This is a striated muscle and can be relaxed consciously by some individuals and unconsciously by others.

(3) With a Levine tube in the stomach, active breathing against a closed glottis drew 50–160 cc. air into the stomach on each attempt.

(4) "Air-suckers" can consciously draw air into the stomach. "Aerophagists" are nervous individuals who do this unconsciously.

(5) During sleep with the superior esophageal sphincter relaxed, attempting to breathe with the tongue dropped back and snoring results in aspiration of air into the stomach.

(6) After learning to relax the superior laryngeal sphincter, the laryngectomized patient can obstruct the tracheotomy opening and produce a negative intra-esophageal pressure by attempting to breath. After a time these patients learn to do this without obstructing the tracheotomy.

(7) With a Levine tube to the lower esophagus only, respirations create negative intra-esophageal pressure and thereby "aspirate" air.

The authors present studies on belching, swallowing movements, and the entrance of air into the stomach during anesthesia and operations, the rate of passage of air through the gastrointestinal tract and meteorism during pyelography. Many individuals afflicted with belching are nervous, irritable people. This is a

modification of aerophagy. It is often seen as a manifestation of nervousness and apprehension in surgical patients and may be responsible, in part, for their abdominal distention. It was shown experimentally, using individuals who could consciously "air-suck," that more air is "aspirated" than is eructed. Therefore, the retained air in frequent belching enters the stomach and intestinal tract and can be held responsible for distention.

During anesthesia and operations, it has been observed that many swallowing movements take place, particularly during the induction stage of anesthesia, possibly accounting for the ingestion of air. The authors believe that frequent swallowing did not occur, but that gastric distention with air occurred nevertheless. They found an average of 1.5 swallows per patient in the induction stage as against an average of 79 swallows previously reported. The authors' series were observed under swift, modern inhalation induction, whereas the latter were observed under longer ether inductions. It was noted that little gas entered the stomach during the operations except in those with obstructed airways. In those patients in whom curare was used and intercostal paralysis resulted, the positive pressure method of breathing for the patients was thought to cause air to enter the stomach. This occurred to a much lesser degree in patients with the same anesthesia but upon whom positive pressure was not used. Gastric dilatation has long been regarded by anesthetists to be a complication of this method of anesthesia. One case is cited in which gastric dilatation during operation occurred to the extent of perforating the stomach.

Extensive studies were made on the rapid passage of gas through the gastrointestinal tract. It was shown that oxygen or air passed from the lower esophagus through the rectum in an average of 24.1 minutes as compared with eighteen to twenty-four hours required for the passage of barium. These findings corroborate the earlier results of Magnusson. Prostigmine methyl sulfate did not influence the rate of passage of gas. Numerous theories for explaining the presence of gas in the intestinal tract are reviewed.

During intravenous pyelography, an emotionally disturbing procedure for some patients, it was found that rather large amounts of gas were aspirated. The amount aspirated was distinctly larger in nervous excitable patients than in calm individuals. This was demonstrated by aspiration of the gas from the stomach via a Levine tube as well as on the serial roentgenograms. In those patients where the gas was continuously aspirated from the stomach, gas accumulation in the intestinal tract was not observed.—*K. L. Krabbenhoft., M.D.*

FELDMAN, MAURICE. Bolsa gasosa sub-hepática isolada em consequência à uma perfuração punctiforme complicando a úlcera duodenal. (Isolated subhepatic gas-pocket following punctiform perforation as a complication of duodenal ulcer.) *Rev. brasil de gastroenterol.*, Sept–Oct., 1949, *1*, 431–434.

Two types of pin-point perforation of the duodenal wall resulting in walled-off gas-pockets are described. In the medical type the pocket is small and escapes detection unless roentgen examination is made before absorption of the gas. The diagnosis of the surgical type is easier because the gas-pocket is large and the presence of gas is more constant. Localized peritonitis is frequently noted in the surgical type. The clinical symptoms are more severe but may subside temporarily. A case of such chronic perforation is presented in which the manifestations of perforation preceded surgical intervention by five months. The gas-pockets, as a rule, cannot be demonstrated in lateral decubitus of the patient and are difficult to diagnose fluoroscopically. The best roentgenographic position for their visualization is the erect view. Punctiform duodenal perforations should be differentiated clinically and roentgenologically from other non-punctiform chronic types of perforations which show a large area of communication between the ulcer and the gas-filled pocket and in which extensive passage of air and barium solution into the sacculation is observed.—*E. A. Schmidt, M.D.*

DOMÍNGUEZ QUESADA, SERAFÍN. La intubación intestinal con la sonda de Harris; técnica y resultados obtenidos. (Intestinal intubation with the Harris tube; technique and results obtained.) *Arch. Hosp. Univ., Habana*, Sept–Oct., 1949, *1*, 439–460.

The author gives a brief review of the historical evolution and of the indications of intestinal intubation, and reports his experience with the Harris tube which he has used regularly in 20 patients since February, 1949.

The various techniques and tubes are discussed, special attention being paid to the tubes of Miller-Abbott, Wild, Cantor, and Honor-Smathers which are illustrated diagrammatically.

The Harris tube is 6 feet long and 5 mm. in diameter. At its distal end it is weighted with a rubber bag containing 4 cc. of mercury to facilitate its progression. According to the author, it is especially suited for the treatment of simple obstruction of the small intestine.

The following are the advantages of the Harris tube: it is readily inserted through the naris into the stomach; it passes spontaneously through the pylorus in a high percentage of cases; its greater diameter allows a better drainage than the double-lumened tubes; it is easier to handle; it is well tolerated by the patient and if proper care is observed the complications resulting from its use are few.

In the 20 patients in which the author employed the Harris tube, 83.3 per cent responded favorably and 16.7 per cent were failures. Roentgenograms of several cases are reproduced to show the progression of the tube and some of the difficulties encountered.—*T. Leucutia, M.D.*

Caffaratti, Enrico. Reperti radiologici e reperti chirurgici nell'ulcera del bulbo duodenale. (Roentgenological and surgical reports in ulcers of the duodenal bulb.) *Ann. radiol. diag.*, Jan–Feb., 1950, *22*, 58–73.

Over a period of two years the author was able to collect 225 cases of duodenal ulcers which were treated by gastric resection. He compares the roentgenological findings with the surgical reports which are the basis of this study.

The results of this study are: (1) the highest number of duodenal ulcers occur in the anterior or posterior wall of the duodenal bulb; (2) it is important to demonstrate the ulcer crater which supersedes any other roentgen finding and therefore should be diligently searched for; (3) the crater sometimes represents the actual loss of tissue substance, whereas in other cases it may be due more to spasm about the ulcerated area which likewise is a very important finding; (4) one may be able to distinguish from the roentgen findings between an acute ulcer, a chronic ulcer and a scarred ulcer; (5) duodenal bulb deformity which accompanies early ulcers is strictly functional, and therefore cannot be detected on surgical specimens. In the later stages of development of the ulcer, the deformities are due more to scars and adhesions, which are permanent changes and can be correlated with surgical reports.—*P. E. Russo, M.D.*

Warthin, Thomas A., Warren, Richard, and Wissing, Egon G. Combined medical and surgical management of upper gastrointestinal hemorrhage. *New England J. Med.*, Sept. 29, 1949, *241*, 473–478.

During a recent two year period at the West Roxbury Veterans Administration Hospital, 181 patients, or 1.7 per cent of all hospital admissions, were admitted for upper gastrointestinal bleeding, 0.8 per cent being for massive hemorrhage (red cell count falling below 3,000,000). During the same period 494 patients with peptic ulcer were admitted, 23 per cent for hemorrhage. Of the 86 cases of massive hemorrhage, 56, or 65 per cent, were due to peptic ulcer, the remaining 30 to esophageal varices, gastritis, or unknown conditions. In 15 per cent of the patients no site of origin of the hemorrhage could be discovered. In the patients bleeding from peptic ulcer, 85.7 per cent were due to duodenal ulcer, 12.6 per cent to gastric ulcer, and 1.7 per cent to marginal ulcer.

A combined medical, surgical and roentgenological team directed the management of the 86 cases of massive hemorrhage. Mortality with ulcer was 3.6 per cent, with non-ulcer bleeders 30 per cent. Absence of hematemesis proved to indicate a less serious degree of hemorrhage; hematemesis was present in all fatal cases, and in all cases surgically treated. Sixty-eight per cent of bleeding ulcer patients suffered typical "ulcer pain" during hemorrhage, while similar pain in patients bleeding without ulcer was rare.

An emergency roentgen technique using thin barium, with the patient examined in prone and supine positions only, without compression technique, was employed on patients with persistent or recurrent bleeding in whom urgent surgery was considered indicated, or in patients with recurrent bleeding in whom previous examinations had failed to localize the bleeding source. Twenty-two per cent of the patients with massive bleeding had such an emergency gastrointestinal series performed during bleeding, in all but one of these a satisfactory diagnosis being reached. In one patient, the roentgen examination was thought possibly to have

contributed to recurrence of bleeding.—*H. P. Brean, M.D.*

MASON, STEPHEN C., and POLLARD, H. M. Peptic ulcer following splanchnicectomy; report of thirteen cases. *Surg., Gynec. & Obst.*, Sept., 1949, *89*, 271–284.

In a group of 1,498 patients who underwent a splanchnicectomy for hypertension during an eleven year period there were 13 cases of peptic ulcer following operation. Three of these had proved ulcers preoperatively while in 4 a presumptive diagnosis of ulcer was made. In 3 others symptoms which were suggestive of peptic ulcer were present. Postoperatively an ulcer was demonstrated in 9 cases and a presumptive diagnosis was made in 3 other patients.

About 2.5 per cent of the entire group of 1,498 patients were considered to have a definite preoperative history of peptic ulcer and 21 per cent of these reported a recurrence following splanchnicectomy.

Preoperatively only 4 patients had a complication of their ulcer. In each case this complication was hemorrhage and it was usually of no great severity. By contrast 11 of the 12 ulcers which appeared after splanchnicectomy were complicated. It was frequently only by this complication that the ulcer definitely announced its presence. Five of these patients had severe complications; 2 were fatal and the other 3 required emergency laparotomy. One of these was for the closure of a perforation. The other 2 were necessary to ligate arterial bleeders in the base of the ulcer. Of the latter 2 patients, one had an active ulcer at the time of splanchnicectomy and the other probably also had one.

It seems clear that following splanchnicectomy frequent and severe complications of peptic ulcer developed in these 12 patients because the normal epigastric pain sensations were either abolished or greatly reduced so that the ulcers were permitted to advance to dangerous proportions without giving the usual warning. Whether the splanchnicectomy itself caused the ulcers or not cannot be concluded from the findings presented. However, 4 patients developed their first ulcer postoperatively and 2 of these resulted in fatal hemorrhages. The patients with the longest history of peptic ulcer before operation usually developed the more serious complications.—*Mary Frances Vastine, M.D.*

HEALY, M. J., JR., and SAUER, P. K. Some limitations of vagotomy in the treatment of peptic ulcer; a critical follow-up of fifty cases. *Ann. Surg.*, Dec., 1949, *130*, 985–1007.

A follow-up analysis of 50 cases of intractable, non-obstructing duodenal ulcer (41) and marginal gastrojejunal ulcer (9) treated by transthoracic vagotomy is presented. In none of the cases was there supplemental surgery on the stomach.

In the immediate postoperative period, the subjective results were uniformly good, with complete or near complete relief of pain in all but two patients. Objectively the night secretion of the stomach was reduced in amount and relative acidity. In the later postoperative period the most troublesome feature was due to disturbance in gastric motility incident to the nerve section, and this manifested itself as fullness, belching, pyrosis, regurgitation, and vomiting. Barium study of the stomach confirmed the manifestations of deranged gastric physiology. Normal motility of the stomach was observed in only 49 per cent of cases.

The long term follow-up studies were accomplished by personal interview of the patients and careful laboratory and roentgen studies. The length of time after vagotomy varied from six to thirty months. By subjective criteria, 34 per cent of the patients were classified as failures. In 38 per cent there was roentgen evidence of recurrence or persistence of an active ulcer (30 per cent duodenal and 8 per cent marginal), and 42 per cent presented some form of gastric atony such as gastric enlargement, diminution in tone of the stomach, decreased peristalsis, and retention of gastric contents.

Numerous illustrative case histories and roentgenograms emphasize the authors' conclusion that "there are serious limitations of vagotomy in the treatment of duodenal and marginal ulcer."—*Harold Fulton, M.D.*

DRAGSTEDT, L. R., CAMP, E. H., and FRITZ, J. M. Recurrence of gastric ulcer after complete vagotomy. *Ann. Surg.*, Oct., 1949, *130*, 843–854.

Vagotomy alone in 17 patients with gastric ulcer produced in at least 5 of the cases no symptomatic relief or objective evidence of healing of the ulcer. In a group of 197 patients with duodenal ulcers treated by complete vagotomy alone, gastric ulcer subsequently developed in 2 patients, in spite of the abolition

of nocturnal gastric hypersecretion. Because hypersecretion of neurogenic origin is *not* present in patients with gastric ulcer, vagotomy as the sole method of treatment is not indicated. The authors believe that subtotal gastrectomy is adequate treatment even if the ulcer should prove to be malignant.—*Harold Fulton, M.D.*

Warmoes, F. L'antrite déformante secondaire à l'ulcère de l'angle de la petite courbure. (Deforming antritis secondary to ulcer about the incisura angularis of the lesser curvature.) *Acta gastro-enterol. belg.*, Jan., 1950, *13*, 19–24.

Deformity of the antrum is a frequent finding, resulting from sclerosis along the lesser curvature, inflammatory swelling of the gastric mucosa and wall, periantritis, and pyloric hypertrophy. An ulcer about the incisura angularis of the lesser curvature is nearly always responsible for secondary deforming antritis or stenosis which may persist even after the healing of this ulcer. Pyloric hypertrophy is due to secondary deforming antritis, and, in the author's opinion, is often a complication of ulceration of the prepyloric lesser curvature. The corresponding ulcer niche is usually small and located on the posterior aspect of the lesser curvature; it is not visible outside of periods of ulcer activity. Stasis of barium in the stomach is functional and ceases when the ulcer has healed even though the secondary deforming antritis may persist. This point is well demonstrated by the study of 9 cases of pyloric hypertrophy confirmed by operation.—*Jean Bouchard, M.D.*

Albot, Guy, and Magnier, Francois. L'atrésie fibro-musculaire de l'antre prépylorique et son substratum anatomique. (Fibromuscular atresia of the prepyloric antrum and its pathological explanation.) *Acta gastro-enterol. belg.*, Jan., 1950, *13*, 14–18.

Fibromuscular atresia of the prepyloric antrum is not a new entity and is defined by the authors as a non-neoplastic linitis plastica. Fibromuscular atresia related to ulcer of the lesser curvature is excluded from the present discussion.

Two forms of atresia are described. In fibrous atresia the mucosa is involved with atropho-hypertrophic gastritis while the whole gastric wall is thickened with diffuse sclerosis, and it shows, roentgenologically, as a complete and even stenosis. In the muscular form there is marked atrophy of the antral mucosa with considerable hyperplasia of all the muscular fibers, producing roentgenologically, an apparent lengthening and narrowing of the pyloric canal with the concave outline of the base of the duodenal cap described by Kirklin. Usually these two forms are mixed and associated, giving roentgen appearances which are atypical and difficult to differentiate from cancer.

Idiopathic fibromuscular atresia of the gastric antrum is an uncommon disease representing a form of chronic gastritis involving the whole gastric wall. It presents a difficult diagnostic problem roentgenologically. Conservative medical management is advisable unless the clinical and roentgenological evolution of the disease would arouse suspicion of malignancy, in which case a surgical approach with gastrectomy becomes indicated.—*Jean Bouchard, M.D.*

Dalla Bernardina, Lino. Studio dello stomaco normale ed operato con il pasto opaco molto caldo. (Study of the normal and operated stomach with a very warm opaque meal.) *Ann. radiol. diag.*, Jan–Feb., 1950, *22*, 37–57.

The author has continued his use of the heated barium meal in the fluoroscopic examination of the stomach. In a previous report he described this technique in detail. His experience with this method has demonstrated certain advantages over the routine barium mixture. Spasm, hyperperistalsis, and reflex functional changes from diseased organs in the vicinity of the stomach can be influenced with a hot barium meal so that they do not interfere with the examination. The author does not imply that this should replace our present method of examination but rather supplement it in those cases in which the routine examination does not disclose the diagnosis.

His report includes cases of hypertrophic gastritis, gastric and duodenal ulcers, tumors and stomachs after partial resection. He finds the warm barium meal of particular advantage in cases of deep gastric ulcers and tumors.

He has found that the heated barium meal causes no real inconvenience to the patient. No contraindications are listed including cases of gastric ulcers in which one may fear recurrence of bleeding. Thus he advocates that when the conventional method of examining the stomach fails to reveal the definite cause of a

spasm, this supplementary method with the heated barium meal be used to relax the tonus of the stomach.—*P. E. Russo, M.D.*

ZINNINGER, M. M., and COLLINS, W. T. Extension of carcinoma of the stomach into the duodenum and esophagus. *Ann. Surg.*, Sept., 1949, *130*, 557–566.

Extension of carcinoma of the stomach into the wall of the organ itself and into the duodenum distally and the esophagus proximally, was studied in 47 stomach specimens. The stomachs were removed by various surgeons and apparently the resection in each case was considered by the surgeon to be adequate for the particular malignant lesion of the stomach. Large microscopic sections were prepared from these operative specimens.

Of the 30 stomachs in which the tumor lay grossly within 5 cm. of the pylorus, none showed any evidence grossly of invasion beyond the stomach, but microscopically, 9 (30 per cent) showed invasion of the duodenal wall by neoplastic cells. The average length of extension was 16 mm. This was in the form of direct infiltration of the muscle or extension into subserosal lymphatics. In only 3 cases was there involvement of the submucosa, one of the chief sites for extension in the stomach proper and into the esophagus.

Of the 6 cases of carcinoma in the cardiac region of the stomach, 5 showed invasion of the esophageal wall, although this was apparent grossly in only 2 of them. The extension was principally in the submucosa and extended an average of 25 mm. beyond the proximal end of the visible tumor.

Extensions in the wall of the stomach itself, mainly in the submucosal lymphatics, varied within wide limits, there being no correlation between the microscopic nature of the tumor and the extent of the microscopic spread. More important, there was no way in which the likelihood of extension could be predicted from the gross appearance of the tumor.

No statement is made by the authors concerning the correlation between the preoperative roentgenographic interpretation of extent of the disease and the postoperative pathologic findings. The fact that in 9 of the 47 cases the line of resection was through an area containing malignant cells, however, indicates that such extension probably cannot be easily detected by the radiologist. A plea is therefore made for wider resections in cancer of the stomach, and for this purpose the abdominothoracic approach is recommended.—*Harold Fulton, M.D.*

WALTHER, O. Beitrag zur röntgenologischen Abklärung palpabler Tumoren des Magendarmtraktus im Bereich des kleinen Beckens. (Contribution to the roentgen visualization of palpable tumors of the gastrointestinal tract in the region of the small pelvis.) *Radiol. clin.*, Sept., 1949, *18*, 254–257.

The author reports briefly 3 cases of malignant tumors of the small pelvis which he has observed within a period of a few months and which constituted rather difficult diagnostic problems.

In the first case roentgen examination revealed a large inoperable tumor surrounding a loop of the small bowel and a considerable portion of the sigmoid colon which it had perforated. The operation showed the tumor to be a spindle-cell sarcoma originating from the soft tissues of the pelvis. The tumor had grown through the intestinal wall in several places, clinically simulating the appearance of a primary carcinoma of the colon with repeated bleedings and symptoms of stenosis.

Similar findings were noted in the second case. Roentgenologically there was evidence of angulation and rigidity of the sigmoid colon with several larger filling defects and a circular narrowing of the lumen at the distal end. A cystogram revealed pressure on the bladder. At operation an adenocarcinoma of the sigmoid colon was found which apparently constituted the primary lesion.

The third case was most difficult to diagnose. Repeated roentgen studies showed extensive adhesions of the lower loops of the ileum with secondary fixation. Some of the loops appeared distended, others were empty. There was considerable variation in the time of passage of the barium meal so that a stenosing tumor of the small bowel was ruled out. At operation a circumscribed spherical tumor was found which on histologic study proved to be a leiomyosarcoma. This tumor originated from the outer wall of one of the loops of the ileum. The inner layers and the mucosa of the intestine were intact, explaining the occasional normal passage of the barium meal through the involved area.—*T. Leucutia, M.D.*

DOLL, RICHARD. Perforated carcinoma of the stomach simulating perforated gastric ulcer. *Brit. M. J.*, Jan. 28, 1950, *1*, 215–218.

Perforation of gastric carcinomas is said to occur in 4 per cent of cases but only half of these come to surgery. The signs and symptoms are those of a perforated benign gastric ulcer. Unfortunately, in the vast majority of cases the carcinomatous nature of the ulcer is not recognized at the time of surgery.

The author reports on 449 operative cases of supposedly benign perforations of the stomach and duodenum. Perforation of benign ulcers occurs 12 times more often in males, whereas the sex ratio for all ulcers is 5 to 1. In the entire group it was found that the risk of the perforated ulcer being malignant was 1.8 per cent. In males the risk rises to 8.1 per cent that the perforated gastric ulcer will be malignant.

The author found 11 cases of perforation of malignant gastric ulcer in his series and in only 4 was the correct diagnosis made at the time of closure. This is unfortunate since this type of perforation occurs when the carcinoma is small and the chance that surgical resection will give a favorable prognosis is greatest.

The author observes that there is no way that the diagnosis can be suspected. Even biopsy is not reliable. He believes that special attention must be focused on the entire group of perforated gastric ulcers in males. The possibility of treating these cases with immediate gastrectomy is explored and advocated by the author, because of the risk of carcinoma and because most cases have relapses or other major complications within four years.

Eight case histories stressing the above points are presented.—*R. A. Hays, M.D.*

Storch, C., Redner, B., and Turin, R. D. Small bowel obstruction in infancy and childhood; a radiological interpretation. *J. Pediat.*, Sept., 1949, *35*, 366–372.

The roentgen diagnosis of small bowel obstruction is difficult in infants because of the presence of air in the small bowel normally in these patients. A distinction must be made between normal and excessive amounts of air. In infants it is normal to find gas in the small bowel up to the age of two or three years. Gas is said to enter the small bowel within the first hour of life and reach the large bowel within three hours.

The authors describe various small bowel gas patterns in the infant with obstruction. They describe the normal air-containing small bowel as resembling a formless, shapeless mass with a hazy washed-out appearance. In the obstructed bowel the gas-filled loops start to bulge and become "squared-off" in appearance. This is due to the impingement of the loops upon one another. With increasing accumulation of gas the bowel becomes blacker. Next a continuity develops to the small bowel loops, leading to "hair-pin" turns, and finally layering or the more commonly described "step-ladder" appearance. The final stage is the development of fluid levels.

Gas patterns in the colon suggesting continuity must be distinguished from abnormal obstructed small bowel. Of aid in this differentiation is the presence of Kirkring's folds in the small bowel which extend across the lumen of the bowel in contradistinction to the plicae semilunares of the colon which extend only partially across the bowel lumen. Of value also is the peripheral distribution of colonic gas and the central position of small bowel gas.

The article is accompanied by schematic examples of small bowel gas patterns and also several illustrative case reports with film reproductions.—*R. M. Harvey, M.D.*

Glover, Donald M., and Barry, Frank McA. Intestinal obstruction in the newborn. *Ann. Surg.*, Sept., 1949, *130*, 480–511.

The mortality of newborn infants with intestinal obstruction has steadily decreased during the past three decades, but still remains comparatively higher than in the adults. The pertinent causes of mortality in this group are: (1) many of these babies are born prematurely and have other associated anomalies, (2) delayed operation due to inaccurate or tardy diagnosis, (3) inadequate supportive therapy, (4) operative indecision and unphysiologic operative measures.

The authors state that bile-containing vomitus from a newborn infant with a distended abdomen on the first day of life signifies intestinal obstruction due to an anomaly until disproved. The authors present many differential points in the histories and physical examinations which aid in locating the site and nature of obstruction in the gastrointestinal tract. The plain or "flat" roentgenogram is the most valuable diagnostic aid. Usually the involved segment can be identified with accuracy by this means. Multiple distended and gasfilled loops of intestine, fluid levels within these loops, free fluid in the peritoneal cavity, and pneumoperitoneum are variously seen in these

roentgenograms. It is only when the diagnosis is obscure that the use of barium is warranted since it may complicate the postoperative course. In short, the history of vomiting soon after birth, together with abdominal distention and abdominal gas shadows in the plain roentgenogram warrants a tentative diagnosis of intestinal obstruction due to a congenital abnormality.

The authors discuss the importance of adequate supportive measures in the surgical management of these cases. Since a large percentage of these cases are premature at birth, the judicious administration of fluids, electrolytes, blood, and antibiotics is of prime importance. The technical problems encountered are discussed.

Details of the operative management are given, stressing the need for thorough exploration since multiple causes of obstruction are known to exist in a given patient. The surgeon should be familiar with the relative frequency with which certain anomalies occur and their sites of occurrence. These are listed in detail by the authors. Meticulous examination of the entire intra-abdominal intestinal tract is necessary and the steps involved in such an examination, especially as it concerns the duodenum, are nicely diagrammed.

Twenty-six case reports of intrinsic obstruction and 20 case reports of extrinsic obstruction are presented. Extrinsic duodenal obstruction is usually due to malrotation. Intrinsic duodenal obstruction is usually due to atresia. Other less common causes of obstruction are ring pancreas, retroperitoneal hernia, intramesenteric hernia, and volvulus about remnants of the omphalomesenteric duct. The various technical surgical measures used in correcting these intestinal abnormalities are discussed in detail.

The most significant single factor in determining the mortality in a given case seems to be the presence or absence of complete obstruction. Surgical errors are one of the major causes of failure. Five tables listing the various causes and group incidence of mortality are presented.—*K. L. Krabbenhoft, M.D.*

CAMP, RAYMOND, and ROBERTS, M. HINES. Multiple calcareous deposits in the intestinal tract of the newborn; report of a case associated with stenosis of the ileum. *Am. J. Dis. Child.*, Sept., 1949, *78*, 393–400.

Calcium deposits occurring in the meconium of the newborn, under certain pathologic conditions, have been frequently reported. Such observations have usually been made on infants with meconium ileus and peritonitis, the calcified material existing as yellowish flakes in the peritoneal cavity or being plastered to the intestine and various viscera. Rarely has there been any mention of the occurrence of calcification within the intestinal tract, and even in these cases there has always been an accompanying perforation of the intestine with local or general peritonitis.

In the case reported a roentgenogram taken at one hour of age showed innumerable calcium deposits scattered through the greatly distended abdomen. At postmortem a severe stenosis of the distal 5 cm. of the ileum was shown. Numerous small concretions were noted in the intestinal and gastric contents. These appeared to consist of a central necrotic mass of cells, some of which were suggestive of squamous epithelium, others of degenerative gastrointestinal columnar epithelium. The central mass of cells was surrounded by extensive mucus. Calcification of the concretions was prominent.

The cause for the deposition of calcium in the intestinal tract is obscure. The authors believe it likely that the deposition of calcium in the intestinal tract of the infant was due to local condition existing in the ileum and not to any systemic disease in either mother or child. There appears to be two sources of calcium: that swallowed in the amniotic fluid and that excreted into the small bowel directly from the blood of the fetus. Certain conditions conducive to the deposition of calcium were known to exist in their case, chief of which was the presence of calcium and fats in considerable amounts in the intestinal tract. Whether a change in the pH of the intestinal contents toward alkalinity was the determining factor cannot be stated, as the reaction of the contents at the time of operation was not determined.—*R. S. Bromer, M.D.*

HEFKE, HANS W. Reliability of roentgen examination in hypertrophic pyloric stenosis in infants. *Radiology*, Dec., 1949, *53*, 789–792.

The author points out that hypertrophic pyloric stenosis is most common condition requiring surgery in first few months of life. Symptoms are described. He reviews the literature and concludes that there are a considerable percentage of cases which, after exhaustion

of clinical diagnostic measures, remain questionable or need prolonged observation before a reliable diagnosis can be made.

The author reviews records of 214 consecutive patients upon whom diagnosis was made and operation performed without a single death. Roentgen examination is most accurate and reliable means of diagnosis of pyloric stenosis and furnishes one of earliest pathognomonic signs. The technique used is that of Neuwissen and Sloof, and is discussed in more detail. The most reliable roentgen sign is the demonstration of the narrowed elongated pyloric canal, the so-called "pyloric string sign."

Of the 210 cases in which the roentgen diagnosis of pyloric stenosis was made, 205 were subjected to surgery and diagnosis was confirmed in 203 cases. Only once in 150 cases where roentgen examination was negative was the diagnosis confirmed surgically. The author concludes that roentgen examination is the most reliable means for the diagnosis of pyloric stenosis without danger to the infant.—*R. D. Moreton, M.D.*

Silverman, Frederic N., and Caffey, John. Congenital obstructions of the alimentary tract in infants and children: errors of rotation of the midgut. *Radiology*, Dec., 1949, *53*, 781–788.

Emphasis is placed on the value of the roentgen examination of the gastrointestinal tract in infants and children when there is a question of obstruction. The authors discuss the causes of intestinal obstruction in infants and children and point out that extrinsic obstruction resulting from errors of rotation of the midgut are quite a problem because such an obstruction may be present for years before becoming complete. A thorough discussion of the embryology of rotation of the intestinal tract is given. It is emphasized that individuals with errors or rotation may be asymptomatic but frequently show malnutrition and have recurrent spells of vomiting. The single most valuable roentgen procedure which may give a clue to an error of rotation is the barium enema. Malposition or abnormal motility of the cecum indicates incomplete fixation of the mesentery and this in turn suggests that the clinical symptoms are due to obstruction by volvulus, peritoneal bands or extrinsic pressure by other organs. The roentgen diagnosis of this condition makes surgical exploration necessary for the obstruction can usually be relieved.—*C. A. Stevenson, M.D.*

Bjerkelund, C. J. Symptomatic sprue. *Acta med. Scandinav.*, 1950, *137*, 130–149.

"Symptomatic sprue" is a name given to conditions in which pathologic changes in the intestines or in the mesentery are the cause of the sprue syndrome. The reduced fat absorption because of the blockage of the lymphatics of the mesentery, or extensive damage of the intestinal wall, is considered as the decisive pathogenetic factor in these cases.

The sprue syndrome has been described in malignant lymphoid tumors, lipodystrophy, chylangioma in the mesentery, tuberculosis of the mesenteric lymph nodes, tuberculous enterocolitis, regional enteritis, gastrointestinal fistula, intestinal strictures, and after anastomotic operations and extensive resections of the small intestine.

The clinical picture of symptomatic sprue may resemble that of idiopathic steatorrhea. The most important symptoms are: steatorrhea, emaciation, anemia, glossitis, stomatitis, hypotension, low sugar tolerance curve, hypoproteinemia, hypocalcemia and osteoporosis.

It is emphasized that the primary pathologic changes in symptomatic sprue not only affect the lymphatics of the mesentery, but also the mucous membrane of the intestine, either primarily or secondarily, as a result of disturbed blood circulation in the mesentery.—*Charles Nice, M.D.*

Hendrix, J. P., Black-Schaffer, B., Withers, R. W., and Handler, P. Whipple's intestinal lipodystrophy; report of four cases and discussion of possible pathogenic factors. *Arch. Int. Med.*, Jan., 1950, *85*, 91–131.

In 1907, Whipple described a rare debilitating disease of unknown origin which was characterized clinically by fatty diarrhea and failure of intestinal absorption leading to death. In some respects it resembled the sprue syndrome, but macrocytic anemia is not present. In many of the cases there are chronic arthritis and hypotension. The postmortem examination reveals macrophages in the wall of the small intestine and fat granulomas in the mesenteric lymph nodes.

The authors describe in detail 4 patients seen at the Duke Hospital, all of which have come to autopsy. In addition, they note one more recent case which is still living. In summarizing

the 4 cases which came to autopsy, the authors note that all of these occurred in males between the ages of thirty-three and fifty-six. Their gastrointestinal symptoms followed a fairly uniform pattern with abdominal discomfort, dyspepsia, and diarrhea. The time of onset of the symptoms varied from one-half year to three years prior to death. The evidence of failure of intestinal absorption with extreme cachexia was striking in each case. All patients complained of chronic arthritis. Three out of the four had a chronic cough and all gave a history of malaria. None of the patients showed significant pulmonary disease during life. The pathologic anatomy was almost uniform in all 4 cases. The two lesions which characterized the disease, pathologically, are the finding of large numbers of macrophages in the lamina propria of the small intestine and occasionally in the proximal portion of the colon and, second, lipogranulomatosis of the mesenteric lymph nodes. In addition, the authors point out that there is an absence of significant anatomical evidence of obstructed lymphatics, such as dilated lymph vessels, chyle cysts, and ascites. It is the absence of such changes that rule out chylous obstruction.

In discussing the etiology of this disease, the authors point out the fact that the lesions produced are comparable, but not identical, with those lesions which have been experimentally produced in animals following the absorption of liquid petrolatum. However, Whipple in his original paper and subsequently the authors of this paper were unable to identify the nature of such a substance if it be present.

The value of the roentgen examination in this disease is limited to the gastrointestinal tract. The small intestine shows delayed motility with increased segmentation and fluctuation of the barium with a loss of the normal mucosal detail. While this appearance is not specific for Whipple's disease, it contributes a portion of the clinical syndrome.

If the condition is suspected, a biopsy of the mesenteric lymph nodes is indicated. However, at the present time there is no therapy which seems to be of value.—*G. W. Chamberlin, M.D.*

DEUCHER, W. G. Über die Variabilität der Dünndarmschleimhaut. (On the variability of the mucosa of the small bowel.) *Radiol. clin.*, Sept., 1949, *18*, 265–272.

The author performed a series of experiments in the human for the visualization of the relationship between the mucosal folds and the wall of the barium-filled small intestine. He administered barium perorally two hours prior to surgical intervention to patients who were to be operated on for some abdominal condition. After the abdominal cavity was opened, loops of the small bowel were pulled out and roentgenographed. The exposure time was so regulated that in addition to the barium present within the lumen the soft tissues of the wall were also visualized. Approximately 50 roentgenograms were secured in a total of 8 patients.

Surprisingly, most roentgenograms were so clear that often the intestinal villi were also demonstrated. The author found no similar observations described in the literature. This demonstrability of the villi is a proof of the very fine distribution of the aqueous barium suspension in the small intestine which also makes possible a subtle visualization of its wall. Radiobaryt Siegfried was used for all investigations.

The roentgenograms were separated into two groups. In the first were placed those with a regular and smooth mucosal relief; in the second, those with abnormal patterns such as broadened and wavy folds, irregular and small folds, irregular and broadened folds, marble-like structures of the mucosa and patchy filling residues, as well as one case in which there was only massive filling without mucosal relief present. It is interesting that in one and the same individual the roentgenograms always fell into one group or the other. There was no instance exhibiting patterns belonging to both groups. In the beginning all exposures were made at intervals of two minutes, but later it was found more expedient to take the roentgenograms immediately after visible motions of the bowel; the intervals varying between six and fifteen minutes. Even after such long periods, and in 2 cases, despite the removal of the appendices during this time, no alterations were noted in the mucosal relief changing the pattern from one group into another.

The author also attempted a study of the alterations in the various patterns of the mucosal relief resulting from contraction of the bowel, but this encountered considerable difficulty. Owing to anesthesia and lifting of the intestinal loops from the abdominal cavity, spontaneous movements occurred exceedingly seldom. Even mechanical irritation, such as hammering with instruments or the alternate

spilling of warm and cold saline solutions, provoked only localized contractions amounting to 1 cm. at the most in the transverse and 5 cm. in the longitudinal direction. Somewhat stronger contractions up to 15 cm. in the longitudinal direction were obtained ten minutes after the intramuscular injection of 1 cc. prostigmin (Roche). A true peristaltic contraction was never observed.

The author gives a short interpretation of the mucosal patterns in the two groups and analyzes the effect of the above described limited contractions on them. Typical roentgenograms are used for illustration. Obviously further investigations are necessary before a differentiation between the normal variations of the patterns and the pathologic findings can be established.—*T. Leucutia, M.D.*

Jonsson, S. O. Carcinoids of the small intestine and the stomach. *Acta chir. Scandinav.*, 1949, *98*, 390–395.

Carcinoids of the appendix are not uncommon lesions. They occur with an incidence of 0.4 per cent in operatively removed appendices. In the remainder of the intestinal canal carcinoids are distinctly uncommon.

The author reports on a carcinoid in the distal segment of the ileum in a woman, aged seventy-two, and a carcinoid occurring in the upper portion of the stomach in a woman, aged sixty-nine. In the case of the ileal lesion the patient presented herself with an acute intestinal obstruction. In the gastric carcinoid the patient was examined because of pain in the epigastrium, dark stools and hematemesis. Roentgen examination in this instance showed two rounded polypoid lesions high in the corpus of the stomach.

Carcinoids are frequently multiple lesions, and were long considered to be entirely benign. This concept has been revised, however, since these tumors have been found to give rise to metastases. The author cites several reports showing that the metastatic lesions are exceedingly slow-growing. According to Cameron, not less than 33 per cent of patients with metastatic carcinoid were living eight years after operation.

The author stresses the fact that the presence of metastatic lesions should not alter surgical procedures designed to remove a primary lesion that may give rise to obstruction or other mechanical phenomena.—*E. C. Lasser, M.D.*

Smets, Willy, and Danis, André. La récidive dans l'iléite régionale de Crohn; interprétation pathogénique. (Recurrence in regional ileitis (Crohn); an interpretation of pathogenesis.) *Acta chir. belg.*, Jan., 1950, *49*, 23–46.

The authors present further observations on 2 cases of regional ileitis which were reported first in 1937 and 1939 respectively. One patient was considered cured in 1937 following ileotransverse colostomy with excision of the small bowel and subsequent ileocolic resection. A second resection was necessary in 1948. The second patient was subjected to the same procedures in 1938, for multisegmental disease. He also required a second resection. In both the lesion was limited to the small bowel which was reddened, markedly thickened, stenosed and rigid. The mesentery was thick and contained large inflammatory nodes.

In both cases the small bowel was resected proximal to the lesion through apparently healthy bowel. Sections of the proximal end of the specimen and its contiguous mesentery were restudied. Although the intestine had seemed macroscopically normal, a marked mucosal infiltration by plasmocytes was found but there was no lymphangitic process in the mesentery. The submucosa was not significantly infiltrated but was edematous and hyalinized. Some polymorphonuclear leukocytes and histiocytes were found in the serosa. Apparently the criteria recommended by Bockus which depend on the gross appearance of the bowel and lymphangitic invasion of the mesentery are unreliable.

The authors conclude that chronic stenosing regional enteritis is not regional but is a complication of a more diffuse process. Hence, cure by surgical excision of the grossly localized lesion is unlikely. The disease should be treated medically, the surgeon being concerned only with the complications (stenosis, abscess and fistula) when they threaten the life of the patient.—*M. L. Sussman, M.D.*

Svartz, Nanna, and Ernberg, Torsten. Cancer coli in cases of colitis ulcerosa. *Acta med. Scandinav.*, Dec., 1949, *135*, 444–447.

In 290 cases of ulcerative colitis observed over a ten year period, cancer of the colon developed in 9 cases (i.e., 3.1 per cent). Worthy of note is that in all the cases the cancer appeared after the symptoms of ulcerative colitis had completely or nearly disappeared and the pa-

tients had for a long time felt unusually well. They all thought that they had recovered one and a half to eight years previously.

These observations support the view that inflammatory processes may have an important bearing on the development of cancer.—*Charles Nice, M.D.*

GENTILE, WALTER, and LEVY, SILVIO. Obstrução intestinal por lesões do cólon distal. (Intestinal obstruction due to lesions of the distal colon.) *Rev. brasil de gastroenterol.*, Jan.–Feb., 1950, *2*, 51–70.

In 11 cases of the authors' observation in which lesions of the distal colon caused acute intestinal obstruction the most common pathologic process was adenocarcinoma of the sigmoid or rectum (5 cases). Other causes were volvulus, fecal impaction (fecaloma), granuloma, extrinsic pelvic tumor (inflammatory?) and perforating diverticulosis with pelviperitonitis. In the evaluation of intestinal obstruction, the role of the ileocecal valve is of importance. If this valve is continent, no reflux of the colonic contents into the ileum can take place, and the increased pressure may cause necrosis and perforation of the intestinal lumen.

In the dagnosis of the colonic obstruction, in addition to the history of the case (the acute obstruction is almost always preceded by long periods of constipation interposed with diarrhea), roentgen examination is indispensable. Preliminary films of the abdomen must precede barium enema examinations.—*E. A. Schmidt, M.D.*

PRYDE, ARTHUR W. Multiple venous thrombosis and visceral carcinoma; case report. *Radiology*, Sept., 1949, *53*, 413–416.

The author states that the occurrence of multiple venous thrombosis in association with visceral carcinoma is not uncommon, particularly when the primary lesion is in the body or tail of the pancreas, in the stomach or in the lung. He reports the case of a forty-one year old white male who, over a period of some months, suffered from repeated episodes of venous thrombosis affecting the face, neck, both arms, both legs and probably also the left lung. Admission roentgenograms of the chest suggested the possibility of a superior mediastinal tumor so roentgen therapy was administered to this region as well as to each supraclavicular fossa. The patient died about eight months after the first thrombotic episode and autopsy revealed an alveolar type carcinoma in the left apical region, containing a cavity 4 cm. in diameter. There were metastases in the nodes of the right axilla and the root of the left neck. Numerous venous thrombi, many of them canalized, were found but there was very little if any evidence of gross inflammation of the veins.—*A. E. Childe, M.D.*

JOHNSON, CLIFFORD C., and BAGGENSTOSS, ARCHIE H. Mesenteric vascular occlusion. II. Study of 60 cases of occlusion of arteries, and of 12 cases of occlusion of both arteries and veins. *Proc. Staff Meet., Mayo Clin.*, Dec. 21, 1949, *24*, 649–656.

All cases of mesenteric occlusion encountered at the Mayo Clinic from 1911 to 1945 were studied from the standpoints, mainly, of cause and extent of the occlusion and presence or absence of infarction. Sixty cases of mesenteric arterial occlusion were found. In 57 the superior mesenteric artery only was involved; in 2, the superior and inferior mesenteric arteries; and in 1, the inferior mesenteric artery only.

The pathologic condition most commonly associated with mesenteric arterial occlusion was heart disease. It was present in 35, or 58 per cent, of the cases studied. Conditions which, in turn, had contributed to heart disease were coronary sclerosis in 14 instances, hypertension in 9, rheumatic fever in 5, exophthalmic goiter in 4, bacterial endocarditis in 2 and syphilis in 1. In 12 of the cases of arterial occlusion, an abdominal operation had been completed shortly before the occlusion took place. Auricular fibrillation occurred in 5 of these 12 cases. In only 4 cases was marked arteriosclerosis of the superior mesenteric artery believed to be the cause of thrombosis or infarction of the bowel. In 2 of the 4 cases, closure of the arterial lumen was incomplete. The extent of occlusion of arteries was much less that that found necessary in cases of venous occlusion to produce infarction of any of the intestinal wall.

All patients with infarction as a result of arterial occlusion, or of arterial and venous occlusion, lived an average of only 2.6 days from onset of symptoms of the occlusion. In venous occlusion alone the average length of life from onset of symptoms until death was 6.8 days, in cases in which infarction occurred.—*K. K. Latteier, M.D.*

ORLANDINI, IVO. Studio anatomo radiografico delle vie bilifere intra ed extra epatiche nel

vecchio. (Anatomo-roentgenographic studies of intra- and extra-hepatic biliary ducts in the aged.) *Ann. radiol. diag.*, 1949, *21*, 396–411.

The biliary tract of a group of subjects free of liver or biliary tract disease was injected with an opaque substance in a vehicle of liquid vaseline and essential oil of turpentine. Roentgenograms showed that the biliary tract was fully developed by the twentieth year and showed negligible changes until the seventieth year. In subjects of this age or older, a dilatation of the entire biliary tract was noted which produced an almost twofold increase in the various diameters. This dilatation was even more striking when the liver was atrophic with the dilatation varying almost inversely with the atrophy observed.

Two types of lesser biliary radicles are described: a short, sturdy, closely spaced one; and a longer, linear more sparsely spaced one.—*C. Colangelo, M.D.*

VAN WIEN, A., DESNEUX, J.-J., and VAN GEERTRUYDEN, J. L'exploration radiologique et manométrique des voies biliaires en chirurgie. (Roentgenological and manometric exploration of the biliary tracts in surgery.) *Acta chir. belg.*, Jan., 1950, *49*, 134–146.

The authors present 18 cases of cholangiographic studies with 6 excellent cholangiograms. They utilized Caroli's manometric technique (slowly increasing pressure of injection synchronized with serial cholangiography as the opaque substance progresses in the biliary tracts).

The cases are grouped under three headings: (1) lithiasis—9 cases, (2) non-calcareous obstructions—3 cases, (3) dyskinesias—6 cases. For the first two groups they stress the importance of cholangiography during operation which discloses unsuspected calculi or neoplastic growth causing obstruction at various points of the biliary tract. For biliary dyskinesias and ascertainment of the functional status of Oddi's sphincter, they recommend postoperative cholangiography. The discussions by Dumont and Boulvin support the conclusions of the authors.—*J. N. Sarian, M.D.*

GALIZZI, JOÃO. Litíase biliar associada à úlcera peptica. (Cholelithiasis associated with peptic ulcer.) *Rev. brasil de gastroenterol.*, Jan.–Feb., 1950, *2*, 45–50.

The investigations of the author do not point to a causal relation between cholelithiasis and peptic ulcer. In a material of 170 cases of cholelithiasis and 592 cases of peptic ulcer, the two pathologic entities were found combined in only 15 patients. Considering the frequent occurrence of either disease in the reported age groups, the small percentage of combined occurrence cannot be considered more than a coincidence.—*E. A. Schmidt, M.D.*

CONGIU, ALDO. Segni radiologici diretti d'idatide epatica. (Direct roentgen signs of hydatid cysts of the liver.) *Ann. radiol. diag.*, Jan.–Feb., 1950, *22*, 74–80.

A primary echinococcus cyst of the liver is a rare disease and presents greater difficulty in diagnosis from the roentgenological point of view than when it occurs in the lungs. The condition is most easily detected when it involves the right lobe of the liver which may permit encroachment of the right lower lung field, whereas in other locations in the liver, one may have to resort to special examinations, such as inflation of the colon with air or pneumoperitoneum or hepatography. Three roentgen findings are practically pathognomonic of this disease: globular calcification in the liver, floating bodies within a membrane and circular air images about a soft tissue shadow.

The author reviews the literature on this disease and quotes 4 of his own cases. In 3 of these he was able to demonstrate a calcified cyst in the liver. The last case showed floating bodies within the membrane. This latter sign usually denotes that the mother cyst has ruptured and daughter cells can be recognized within the fluid inside the membrane. Only one case showing the last sign, and air circle about the cyst, has ever been reported by Luccherini. Hydatid cysts of the liver produce vague symptoms and usually simulate diseases of the pleura or gallbladder. They may be discovered on routine examination in the investigation of these diseases.—*P. E. Russo, M.D.*

VASCONCELOS, E., and SADEK, H. M. Pâncreas anular produzindo estenose duodenal; contribuição ao seu diagnóstico; apresentação de um caso. (Annular pancreas producing duodenal stenosis; contribution to its diagnosis; presentation of a case.) *Rev. brasil. de gastroenterol.*, Nov.–Dec., 1949, *1*, 535–551.

The term "annular pancreas" signifies a developmental abnormality in which a ring of

pancreatic tissue surrounds the upper portion of the second portion of the duodenum which may or may not produce constriction and stenosis of the duodenal lumen. Only 53 cases have been described in the medical literature of which 16 were discovered during operation while the remainder were diagnosed during autopsy or anatomical dissection.

The case presented by the author and observed in a seventy year old male of Italian extraction is the first seen in more than 22,000 operations performed at the Hospital das Clinicas of São Paulo. The patient complained of colicky pains in the right hypochondrium, vomiting and eructation, persisting over a period of at least twenty years. Less typical symptoms were observed from the age of thirty years on; before that time, no digestive disturbances were present. The roentgen examination of the stomach and the duodenum revealed immense enlargement of the stomach with extensive fluid stasis in the stomach. Several hours' position in right lateral decubitus showed no passage of the barium meal into the small intestine. Biochemical examinations of the blood revealed fixed acidosis. Surgical intervention confirmed the diagnosis of an annular pancreas which stenosed the lumen of the supravaterian duodenum to the width of a normal appendix. Transmesocolic gastroduodenectomy (Reichel-Pólya method) was performed, and the patient was completely cured. While the diagnosis of duodenal stenosis by annular pancreas rests on the symptomatologic and roentgen findings, the simultaneous examination of the alkaline reserve and of the erythrocyte-plasma chloride ratio is advised as a valuable contribution in the differential diagnosis. According to the authors, duodenal stenosis due to annular pancreas is accompanied by fixed acidosis (decrease of alkaline reserve and increase of chloride ratio).

The developmental aspects of the abnormality and the different methods of surgical treatment (gastroenterostomy, duodenojejunostomy and gastrectomy) are discussed in detail. Section or resection of the pancreatic ring is contraindicated since later pancreatic pseudocysts and fistulae may result.—*E. A. Schmidt, M.D.*

SCOTT, J. V. Pancreatic cyst. *Arch. Surg.*, Dec., 1949, *59*, 1304–1318.

Pancreatic cysts are of five types: (1) developmental; (2) degenerative (inflammatory or traumatic pseudocysts)—the commonest type; (3) obstructive—secondary to stone, carcinoma or proliferation of the epithelium of a pancreatic duct; (4) proliferative—cystadenoma or cystadenocarcinoma; (5) parasitic-hydatid.

Because of the unyielding nature of the vertebral column and of the posterior abdominal wall, any cystic mass developing in the pancreas will point anteriorly. Symptoms and signs depend on the size of the pancreatic mass and the degree of pressure displacement of the adjacent organs. Of the 8 cases encountered by the author in a twelve year period, the majority occurred in women, and the average age of the patients was 48.5 years. The major symptoms were abdominal pain, weight loss, nausea and vomiting, bloating, loss of appetite, and a sense of abdominal fullness. All 8 patients had a palpable upper abdominal mass. The only laboratory finding of any value was a constantly elevated serum amylase level in some of the patients.

The roentgenographic features of pancreatic cysts depend largely on the location of the cyst in the gland. Some of the signs are:

(1) A rounded soft tissue mass in the upper abdomen. There may be calcification in its wall.

(2) The left leaf of the diaphragm may be elevated and show diminished respiratory excursion.

(3) On contrast study, a tumor, extrinsic to the stomach, is found.

(4) Widening of the duodenal loop if the cyst is in the head of the pancreas. There is no anterior displacement of the second portion of the duodenum however.

(5) Increase in the distance between the vertebral bodies and the posterior wall of the stomach, as seen in the lateral projection.

(6) A constant filling of the duodenum with the opaque meal, in contrast to the transient filling of the duodenum in normal subjects.

(7) In cysts deforming the lesser curvature of the stomach, the defective shadow has a smooth contour, with the concavity toward the tumor. Uninterrupted peristaltic waves pass over the filling defect, indicating that it is extrinsic. On pressure over the mass or on change in position of the patient, the defect alters its shape or disappears.

(8) When a cyst is located in the tail of the gland, there is a filling defect on the greater curvature when the patient is prone, with dis-

placement of the stomach upward and to the right. This alters in shape or disappears when the patient is upright. There may also be displacement of the duodenojejunal angle downward, with compression stasis of the third part of the duodenum and poor visualization of the first loop of jejunum.

The differential diagnosis includes omental and mesenteric cysts, hydrops of the gallbladder, hydronephrosis, retroperitoneal tumors, aortic aneurysm, splenic tumors or cysts, tumor of the kidney, adrenal tumor, and perinephritic abscess.—*Harold Fulton, M.D.*

Lustok, Mischa J., and Baum, George L. Calcified splenic cyst; report of a case. *Dis. of Chest*, Sept., 1949, *16*, 329–335.

This is a case report and review of the literature of 31 calcified splenic cysts. A homogeneous ring of calcific density in the left subphrenic area on a chest film led to the roentgenographic investigation. Barium studies, plain film examinations, and pneumoperitoneum procedures were done to give the roentgen diagnosis. All other clinical and etiological studies were noncontributory, with the diagonsis of calcified splenic cyst made by exclusion.—*F. R. Gilmore, M.D.*

GYNECOLOGY AND OBSTETRICS

Moir, J. C. The use of radiographs in assessing disproportion. *Brit. M. J.*, Dec. 24, 1949, *2*, 1437–1440.

As a means to assess pelvic disproportion, three standard charts on graph paper were constructed; one for the pelvic brim, one for the pelvis at the level of the ischial spines, and one for the outlet. Each chart has a range of anteroposterior pelvic measurements indicated on its vertical edge and the transverse measurements along its horizontal edge. Direct measurements are made from a roentgenogram of the pelvis. By correlating a large number of previously observed obstetrical cases in which full roentgen examination had been made, it was possible to indicate on each chart the level at which difficulty was encountered with reference to the degree of head size. The end result was the incorporation in the charts of a series of graphs by which one could tell in any case whether head size would encroach on pelvic size.

An analysis of 193 cases where there was clinical evidence of pelvic abnormality revealed that where easy delivery was indicated by roentgenography and the use of the graphs, the labor in 72 per cent of these cases was found to be short and uneventful. When difficult delivery was indicated by the graphs, the labor in 86 per cent of the cases was found to be prolonged or to require operative assistance.

The author makes a plea for greater use of inter-partum roentgenography. Its use will show whether the greatest diameter of the head has passed through the narrowest part of the pelvis, and whether it is advisable to continue a course of so-called trial labor.—*W. M. Roy, M.D.*

SKELETAL SYSTEM

Harnasch, Hans. Die Akroosteolysis, ein neues Krankheitsbild. (Acro-osteolysis, a new clinical entity.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Jan., 1950, *72*, 352–359.

This is a case report of a bone condition of which the author could find no mention in the literature. It concerns a man, aged forty-three, whose family history was negative. He was a locksmith until 1931 when, because of recurrent eczema of hands, arms, feet and legs when he handled tar or oils, he became a hotel porter. Eczema did not recur. After discharge from a two year service in the army, he again became a locksmith. From then on, the eczema reappeared.

The patient stated that his fingers had become shorter and thicker for the past twenty-five years. There was no loss of sensation and no pain. In recent months, he felt a numbness of his fingers and also very slightly in his feet. Examination revealed a slight degree of prognathism. The fingers of both hands were short and plump. Mobility of the terminal phalanges was unusual, in that there was motion laterally as well as distally and proximally. No muscle weakness was noted. All other findings were normal except the roentgenological.

The roentgen findings may be summarized as follows: (1) Symmetrical defects of all the terminal phalanges of the fingers without bone reaction, with preservation of the nail plates (Fig. 1). (2) Symmetrical destructive changes of the metatarsophalangeal joint of the large toe, with periosteal reaction. (3) Defects, without bone production, of the phalanges of the fourth toe of both feet. (4) Almost total disappearance of the alveolar process of the maxilla and mandible. (5) Questionable healed

inflammatory process of the intervertebral disc between the fifth and sixth cervical vertebrae. (6) Moderate degree of kyphoscoliosis of lower cervical and upper thoracic spine.

There was atrophy of the gingiva about the one remaining tooth, a finding usually not seen when a residual tooth is present. This finding suggested that there had been a primary bone atrophy with secondary loss of the teeth.

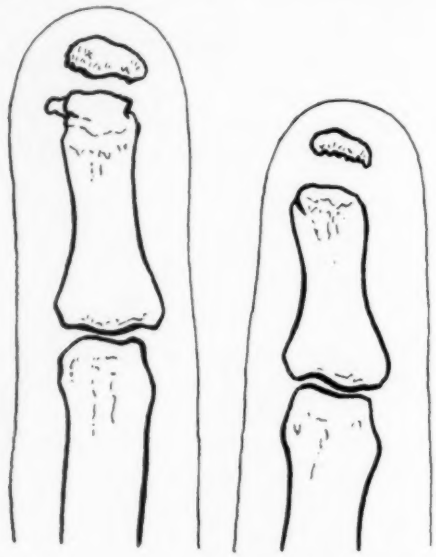

FIG. 1. Acro-osteolysis. (Drawing by Richman from illustration in paper by Harnasch.)

Syringomyelia, leprosy, etc. were ruled out. Theoretically, certain vegetative centers in the mid-brain may be influenced by secretion of the eosinophilic cells of the pituitary. It is believed that in the case presented, there was a hypofunction of the eosinophilic cells of the pituitary. An increase of the sympathetic nerve effect with a preponderance of the osteolytic process would explain the clinical picture described here.

The patient was seen three years later because of pain in both shoulders. Roentgenograms of these parts revealed extensive, symmetrical dissolution of the acromion process of the scapula, with scattered fragments of remaining bone. Re-examination of the hands and feet showed more destruction of the middle phalanx of the right fourth finger, and a new defect in the distal portion of the primary phalanx of the left fifth finger.—*Samuel Richman, M.D.*

RADIOISOTOPES

GRIFFIN, MARK A., JR., GOLAND, PHILIP P., and CHAMBERLAIN, RICHARD H. Localization of radioactive materials in the phantom brain. *Nucleonics*, April, 1950, *6*, 37–43.

In 1948 Moore suggested the use of radioactive diiodo^{131} fluorescein which was made from the fluorescein dye and I^{131} for the diagnosis and localization of brain tumors. He found that when an aqueous solution of this substance was injected intravenously into a patient afflicted with brain tumor a sufficiently large amount of the radioactive dye was taken up by the tumor tissue as to be measurable externally by means of a gamma-ray Geiger counter.

With the purpose of establishing a clinical technique, Marvin and Moore performed a series of experiments in water phantoms containing 20 and 40 cc. volumetric flasks which were filled with radioactive iodine solutions and placed at various sites and depths. It was established that the tumor must have a volume of approximately 40 cc. to be detectable and that best results are obtained with the radian method which is a method of symmetrical counting positions by maintaining the counter normal to the skull.

The authors of the present article describe in detail a modified technique which makes use of a method of rectangular coordinates (orthogonal sets of axes). They also coin the name of "tracer encephalography" for the procedure of localizing a brain tumor with the aid of radioactive materials.

The study was made by placing a rubber balloon "tumor" containing I^{131} solution at different locations within a vinylite plastic "phantom brain." The volume of 40 cc. was chosen for the tumor so as to have comparable values with those of Marvin and Moore. The activity per unit volume of the I^{131} solution of the tumor was 2.5 to 5.5 times greater than that of the fluid filling the remaining space of the phantom brain.

The measurement of the gamma-ray emission was done with the phantom within a skull. About the skull was fixed a rigid rectangular "horizontal" frame which was joined to the collar frame of a Barany chair (Fig. 1*a*). This arrangement constituted a modification of the Horsley-Clarke stereotaxis instrument which is used in an inverse manner for the purpose of producing localized spot lesions at any known depth in the encephalon. The Geiger counter was mounted on a carrier which slotted interchangeably into the collar frame by removable

pins. The gamma rays were collimated by means of a Lysholm type grid which was placed in front of the end-window of the Geiger tube.

The localization of the tumor was registered on a chart by recording the counts in the orthogonal sets of axes (Fig. 1*b*). The zero horizontal plane passed through Reid's base line extending from the lower border of the orbit through the middle of the external auditory meatus and was divided by the zero frontal and sagittal planes into four quadrants. The centers of all tumors were traversed by one of three parallel planes situated 4, 7, and 9 cm. above the horizontal plane. Equidistant planes (at 1 cm. from each other) parallel with the zero sagittal and frontal

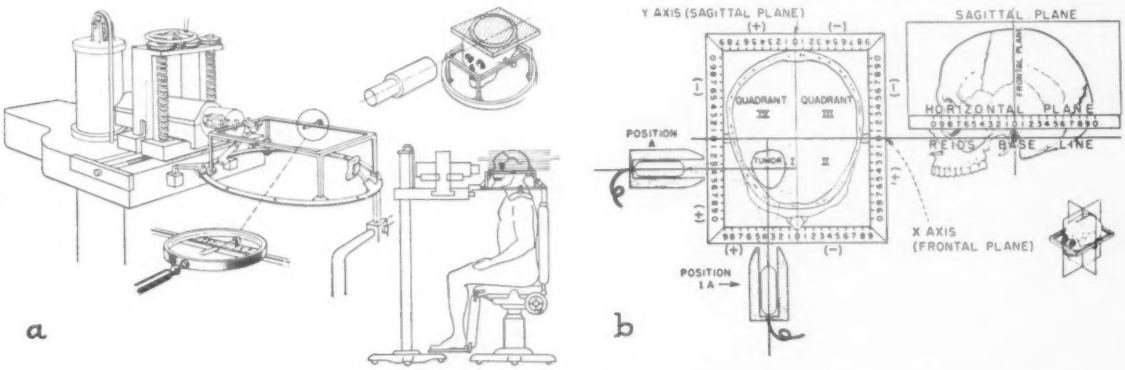

Fig. 1. (*a*) experimental set-up; (*b*) localization chart. (Figures 2 and 4 from paper by Griffin, Goland and Chamberlain. Reproduced by permission. Copyright 1950, McGraw-Hill Publishing Company, Inc.)

planes, on crossing the horizontal plane, divided the quadrants into squares. With the aid of Cartesian coordinates the site of the tumor was easily determined.

The experiments included the localization of ten phantom tumors by using both the method of rectangular coordinates and the method of radians. Seven tumors were localized or approximately localized by the former and only three by the latter. All tumors localized by the method of radians were also localized by the method of rectangular coordinates.

The conclusion is reached that localization of a brain tumor by means of tracer encephalography employing the method of rectangular coordinates has some clinical applicability. Its disadvantage for the present is the fact that it takes about two hours with the head rigidly fixed in the horizontal frame to make a complete survey. It is hoped that with further improvement of radiation detection and collimation and the development of an apparatus using multiple counters the time of examination may be considerably shortened.—*T. Leucutia, M.D.*

MISCELLANEOUS

Rose, John E. Remote-controlled radium emanation plant and automatic measuring apparatus for gold implants. *J. Nat. Cancer Inst.*, Dec., 1949, *10*, 605–623.

This is a technical article describing in minute detail the construction and operation of the radium emanation plant of the U. S. Marine Hospital of Baltimore, Md. The plant was installed in 1941 and has been in continuous operation since that time. It is equipped with remote control of the stopcocks and operates semi-automatically, thus reducing the radiation exposure of the personnel to a minimum. Diagrams are given of the plant, of the parts of the remote-control mechanism; of the automatic measuring cabinet for gold implants, including one each for the upper magazine, ionization chamber and lower receiver; and of the electrical network and wiring of the automatic measuring apparatus. Photographs of the control room, of the plant itself and of the Failla radioactivity recorder are also included.

Briefly, the plant is a variation of the original Failla design developed by Failla and Rose. It consists of two complete systems, one being mounted on each side of a V-shaped frame so that either side may be used in case of breakdown of the other.

The unique feature of remote control has been incorporated by designing a mechanism which permits the operation of the stop-cocks by means of two handles placed on the board in the control room. A wall of concrete 2 feet thick separates the control room from the emanation plant. The operator watches through a low-power telescope and a lead glass window

mounted in the wall.

The emanation source is a weak hydrochloric acid solution of radium stored in a lead-lined safe. It contains, in addition to the radon, impurities consisting of water vapor, hydrogen, and oxygen formed from dissociation of the water, chlorine, and helium which is formed by recombination of the alpha particles. The collection and purification of the radium emanation is described at considerable length.

The system is provided with an arrangement which permits the radon to be put in glass capillary tubing, a glass bulb, or gold capillary tubing, or in any combination of the three, depending upon its intended use. The glass capillary tubes which are used in place of radium in applicators are sealed off with a gas flame. The same procedure is applied for the glass bulbs which are used chiefly for their beta-ray activity. The gold capillary tubes which are applied interstitially are cut off with a pair of diagonal cutting pliers, the malleability of the gold producing self-sealing.

The automatic measuring apparatus for gold implants records the activity of each implant and deposits it in a compartment corresponding to its range of activity. It consists of four separate units: (1) the Failla radioactivity recorder, (2) the electrometer tube unit, (3) the auxiliary relay panel and (4) the measuring cabinet. All are described in detail and their operation is amply discussed. The measuring cabinet has three main sections: (a) the upper magazine; (b) the ionization chamber; and (c) the lower receiver. The implants are placed by the cutting machine into a brass disc of the upper magazine, whence they drop by gravity through a brass tube into the ionization chamber. After being measured they are ejected from the ionization chamber and drop by gravity through another brass tube into the lower receiver. Here the implants are automatically sorted out with the aid of a disc which has 21 pockets. The first pocket receives the duds with no activity, the second the implants ranging from 0 to 0.5 mc. and the remaining pockets receive implants with logarithmically increasing activity. The ionization is recorded by a device which transforms the deflection of a galvanometer into rotation of a shaft transmitted mechanically to a recording pen.—*T. Leucutia, M.D.*

THEISMANN, HANS. Gibt es eine den biologischen Röntgeneffekt steigernde Wirkung des Ultraschalls? (Do ultrasonic waves increase the biologic effect of roentgen rays?) *Strahlentherapie*, Dec., 1949, *80*, 599–606.

Ultrasonic radiation through its hyperemic effect can slightly increase biologic roentgen effect; a variety of factors contribute to the degree of this increase. Healing is accelerated by the use of a combination of ultrasonic and roentgen irradiation in the treatment of tumors of the skin. In such combined tumor therapy, increased roentgen effect results from the local increase in temperature produced by the ultrasonic waves.—*H. G. Moehring, M.D.*

EPSTEIN, B. S., COHEN, H. L., and NATELSON, S. A new series of radiopaque compounds. II. Further notes on the cholecystographic uses of certain iodinated hydroxyphenyl fatty acids. *Radiology*, Jan., 1950, *54*, 87–89.

This is a presentation of some data on compounds for cholecystography. The present authors are in disagreement with Strain *et al.* (*Radiology*, 1948, *51*, 225–236) first, on results with the use of 2-(4-hydroxy-3,5,-diiodobenzyl) benzoic acid; and, second, the use of the dog as an experimental animal for testing cholecystographic compounds.

They indicate that a newer compound 2(4-hydroxy-3,5-diiodobenzyl) cyclohexyl carbonic acid is being investigated and promise a later report.—*J. W. Karr, M.D.*

ELLINGER, F., and BARNETT, J. C. Further studies on the influence of dose fractionation on the lethal x-ray effect produced by total body irradiation in mice. *Radiology*, Jan., 1950, *54*, 90–92.

The authors describe the change in effect of the absolute lethal dose LD 100 of roentgen rays in mice, with fractionation into single doses of various sizes and when different overall exposure times are employed.

A total of 220 mice were used and the factors employed were 200 kv. (peak), 10 ma., 0.25 mm. Cu and 1.0 mm. Al total filtration, having a half-value layer of 0.75 mm. Cu. Doses used were as follows:

(1) 1,000 r given in single exposure,
(2) 1,000 r using 100 N daily on ten consecutive days,
(3) 1,000 r using 100 N doses given over a sixteen day period,
(4) 1,000 r using 75 N for 12 doses and 50 N for 2 doses over 18 day period,
(5) 1,000 r using 50 N over a 20 day period.

The results revealed a greater mortality when the first three doses were used and decreased rapidly with (4) and (5). Thus, in total body irradiation the effect of dose fractionation depends on the size of the single fraction as well as on the length of the over-all exposure time. Of these two factors, the size of the fraction appeared to be the more important. It also appeared, as with observations on tumor destruction, that there exists a certain optimum for dose fractionation in total body irradiation.—*R. D. Moreton, M.D.*

Goldfeder, Anna. Further studies on the relation between radiation effects, cell viability, and induced resistance to malignant growth. VI. Anomalous radiosensitivities of analogous mouse mammary adenocarcinomas. *Radiology*, Jan., 1950, *54*, 93–115.

The author gives a review of the preliminary studies and includes some review of the literature.

For the present study 368 mice of the C_3H strain and 219 of the dba strain were used. The mammary tumor of each strain had been carried on in the author's laboratory for the past three years. The results of this paper deal only with single massive doses of radiation. The tumors were allowed to stay in the animal hosts and either their continuous growth or regression was noted.

One of the outstanding observations made from the study was that two analogous mammary tumors autogenous to two inbred strains of mice, both having the same pathological diagnosis, proved to differ widely in their physiological characteristics.

It was concluded from the observations that where radiosensitivity is concerned the physiological activity of the cell might serve as a more reliable index than its morphological characteristics.

In contrast to the widely accepted belief that faster growing tumors are more radiosensitive than slower growing ones, these experiments substantiate that although this is true of the mammary tumors studied when grown in vitro, it does not hold true in vivo. Explanation of this is made in terms of the metabolic exchange of "wash away" effect.

Active mitosis was found in the (dbrB) mammary tumor, when grown in a young host, forty-seven days after exposure to a dose of 16,000 r. This period corresponds to nearly five years in the life of a human being. In view of these results, it was suggested that follow-up treatment for a period of five years is indicated, particularly in young people.

Another analogy to the human being was the fact that the tumors grew slower in old mice and required less dosage of irradiation for their destruction.

The above points are summed up in the conclusion emphasizing the Bergonié-Tribondeau law of effect of irradiation on tumor cells holds true in vitro and not in vivo, suggesting a more reliable classification of tumors on basis of their biological or physiological characteristics, and that follow-up treatments within a five year period seem to be indicated.—*R. D. Moreton, M.D.*

Marshall, A. G. The effect of tetra-ethyl ammonium bromide on the renal pelvis and ureter; a contribution to the study of hydronephrosis. *Brit. J. Surg.*, Jan., 1950, *37*, 352–356.

The authors report the use of the drug tetraethyl ammonium bromide (T.E.A.B.) in the hope that it may be found useful in investigating the cause of hydronephrosis. This drug is believed to cause blockage of the ganglia of the autonomic nervous system, both sympathetic and parasympathetic. In the course of an investigation into the relationship petween pyelonephritis and hypertension, a series of intravenous pyelograms was obtained in which there was slight dilatation of the renal pelvis or of certain of the calices. In some instances a constriction appeared to be present, and in order to determine if this was the result of muscular spasm, T.E.A.B. was injected intramuscularly and the pyelograms were repeated. Intravenous administration of the drug was not considered entirely safe.

Six case reports are presented with reproductions of the pyelograms. The effect of the drug on the renal pelvis and ureter appears to be a return towards normal in 5 of the 6 cases. The authors feel that it is not extravagant to postulate that autonomic paralysis might allow relaxation, with the result that intrinsic muscular tone may take control.—*D. S. Kellogg, M.D.*

Cozza, Francesco. L'osteogenesi riparatrice della frattura nell'animale paratireoprivo e trattato con vitamina D_2 urto. (Reparative osteogenesis of fracture in animals with hypoparathyroidism treated with vitamin D_2.) *Ann. ital. di chir.*, Jan., 1950, *27*, 16–26.

The author performed experiments on 5 dogs in order to substantiate his belief that vitamin D_2 in proper dosage may exercise a helpful action in relieving the calcium deficiency at the site of fracture in animals with hypoparathyroidism and that overdosage may be detrimental.

According to Canal (1909) osteoid tissue at the site of fracture in animals with hypoparathyroidism does not calcify due to inability of the tissues to mobilize calcium, despite the fact that the surrounding soft tissues may contain excessive amounts of calcium.

All experimental animals had the fractured limb adequately immobilized until the fracture was either completely healed or until pseudarthrosis developed. At that time, animals were sacrificed and the site of the fracture was examined grossly and microscopically for evidence of calcification and bone formation within the osteoid tissue. Blood calcium studies were performed. The parathyroid glands were electrocoagulated in all dogs.

First Dog (7.5 kg.): treated with 250,000 units of vitamin D_2 I.M. every ten days for eighty days. This was considered an adequate dosage. There was normal healing of the fracture roentgenographically, grossly, and microscopically. Blood calcium levels were normal throughout.

Second Dog (6.8 kg.): treated with massive doses of vitamin D_2 (500,000 units I.M. biweekly for sixty days). The dog developed hypocalcemia with delayed healing of the fracture and ultimate pseudarthrosis.

Third Dog (3.5 kg.): treated with massive doses of vitamin D_2 (500,000 units I. M. weekly for sixty days). This dog responded identically to dog 2.

Fourth Dog (5 kg.): treated with massive doses of vitamin D_2 but at long intervals (500,000 units I. M. every fifteen days for two months). The fracture healed slowly but adequately.

In summary, the author feels that these experiments, although not conclusive because of the small number of animals, tend to substantiate his premise that adequate dosage of vitamin D_2 will help healing of fractures in cases of hypoparathyroidism and, conversely, that excessive dosage will be detrimental. He advances the theory that vitamin D_2 enables a greater transfer and utilization of oxygen and calcium at the fracture site and that adequate healing follows.—*C. A. Priviteri, M.D.*